PERCEPTIONS OF COLLABORATION, GENDER, AND COMMUNITY-BASED WATER RESOURCE MANAGEMENT: AN EXPLORATION OF RURAL DEVELOPMENT IN THE WEST AFRICA WATER INITIATIVE

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PERCEPTIONS OF COLLABORATION, GENDER, AND COMMUNITY-BASED WATER RESOURCE MANAGEMENT: AN EXPLORATION OF RURAL DEVELOPMENT IN THE WEST AFRICA WATER INITIATIVE

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ABSTRACT

The impacts of outside interventions on community-based natural resource management are inherently complex, particularly in dynamic political and environmental contexts. As development projects are increasingly participatory, the relationships between stakeholders have become as critical as the innovations themselves. Demands on safe water supplies among the most resource-stressed populations in West Africa are challenging development practitioners to reevaluate their partnerships to retain focus on community need, rather than on operational imperatives.

Fieldwork was conducted between 2006 and 2009 using complementary mixed methods to evaluate a range of structural and behavioral mechanisms shaping water management among farming households in south-central Mali. Examining institutional support, in terms of policy and programming, along with the experiences and perceptions of water users, traditional village leadership, nongovernmental organization (NGO) staff, and government representatives, highlighted many challenges that limit sustainable collaborative development. A gendered-approach to data collection was used to delineate barriers and opportunities for decision-making by marginalized water users.

The key challenges that limit the success of development efforts in improving water resource management are 1) the legitimacy of community-based organizations that lack traditional authority as perceived by members of households, 2) poor perceptions of resource-strapped decentralized government agencies by rural communities, and 3) superficial participation of marginalized populations in local decision-making. In the majority of the study villages, these challenges have led to the decline of institutional and physical infrastructure intended to improve local water resource management.

Opportunities do exist, however, to engage men and women differently in development interventions to increase participation, promote inclusion, and generate lasting partnerships among rural communities, NGOs, and government agencies. These opportunities require compromises to balance the legitimacy of traditional authority with outside development agendas. It is especially important for NGOs, whose roles in local resource management and civil society often fill a necessary void left by government, to capture these opportunities.

Keywords: Community-based resource management, water, collaboration, gender, participation, community-based organization, decentralization, government, NGOs

BIOGRAPHICAL SKETCH

Kimberly Lynn Bothi, and her twin brother Steven were born on December 13, 1976 to Lynda and Steve Bothi. Growing up on the family farm in rural southern Alberta, Canada, a love of the land and the need for responsible agriculture practices was instilled in them by their parents. When not busy with the numerous school, farm, sports, and community activities growing up, Kim spent much of her time hiking, skiing, and biking in the nearby Canadian Rockies and Badlands. Encouraged by her parents, Kim has taken advantage of many opportunities to travel over the years, participating in a student exchange program in high school, traveling across Canada and the United States, and backpacking throughout the Andes in South America, immersing herself in French and Spanish.

Academically, Kim has earned a Diploma in environmental technology from Mount Royal College in Calgary, Alberta, a Bachelor of Science in agricultural and biosystems engineering from McGill University in Montréal, Québec, a Master of Science in biological and environmental engineering and now a Doctor of Philosophy in natural resources from Cornell University in Ithaca, New York. Throughout undergrad, Kim worked as a seasonal environmental technician in the petroleum industry, and post baccalaureate, she worked for an environmental consulting firm, leading the clean up of contaminated oil and gas sites throughout western Canada.

Kim's studies and Ph.D. research has taken her to remote villages in western and southern Africa, as well as through central and southern India where she has studied water management, food security, conservation agriculture, technology adoption, and international extension. In addition to her pursuits in international development, Kim has served the Ithaca community as a firefighter

and EMT, during which time she met and married her husband, Jason Gleghorn, a fellow Cornell graduate. Currently, Kim is working at Innovations for Successful Societies, a Woodrow Wilson School think tank at Princeton University that produces case studies and policy briefs on institutional reform under challenging economic and political conditions around the globe. Kim hopes to integrate her diverse background to improve efforts between development partners and to drive policies that empower marginalized stakeholders in community-based natural resource management.

To Jason, Steve, Dad, and Mom (we miss you)

... for your indelible love and support.

To Mariam Coulibaly

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LIST OF ABBREVIATIONS

ADP	Area Development Program
APROFEM	Promotion de la Femme et de l'Enfant au Mali
AMA	Agence des Musulmans d'Afrique
AEPA	Programme d'Alimentation en Eau Potable et d'Assainissement en Milieu Rural
ANICT	Programme Agence Nationale d'Investissement des Collectivités Territoriales
AOF	Afrique Occidentale Française (federation of French colonial territories)
BREESS	Programme Bureau de Recherche d'Exploitation des Eaux Souterraines et de Surface
CBNRM	Community-based natural resource management
CIIFAD	Cornell International Institute for Food, Agriculture and Development
CFA	Communauté financière d'Afrique (West African franc)
CBO	Community-based organization
CGS	Comité de Gestion Scolaire
CMDT	Compagnie Malienne pour le Développement des Textiles
CRUDEM	Centre Rural de Développement de Milot
CSCOM	Centre de Santé Communautaire
DNA	Direction Nationale de l'Agriculture
DNCT/CCN	Programme Direction Nationale des Collectivités Territoriales/Cellule de Coordination Nationale
DNH	Direction Nationale de l'Hydraulique
DNHE	Direction Nationale de l'Hydraulique et de l'Énergie
DRHE	Direction Regional de l'Hydraulique et de l'Énergie
FAO	Food and Agriculture Organization of the United Nations
FDS	Fondation pour le Développement au Sahel
FODESA	Fonds de Développement en Zone Sahélienne
GRAD	Groupe Action pour le Développement

GRWP	Ghana Rural Water Project
HH	Household
HHH	Head of household
IFAD	International Fund for Agricultural Development
IMF	International Monetary Fund
INSTAT	Institut National de la Statistique (République du Mali)
MATCL	Ministère de l'Administration Territoriale et des Collectivités Locales
MRWP	Mali Rural Water Project
NGO	Nongovernmental organization
NSC	National Steering Committee
OECD	Organisation for Economic Co-operation and Development
OPAM	Office Malien des Produits Agricoles
PAIB	Projet d'Appui aux Initiatives de Base
PACR	Projet d'Appui aux Communautés Rurales (previously PAIB)
PACT	Programme d'Appui aux Collectivités Territoriales
PACTEA	Programme d'Appui aux Collectivités Territoriales pour l'Eau Potable et l'Assainissement
PASACOOP	Projet d'Appui aux Structures Associatives et Coopératives dans les Cercles de San et Djenné
PASAOP	Programme d'Appui aux Service Agricoles et aux Organisations Paysannes
PDR-MS	Programme de Diversification des Revenus en zone non-cotonniére du Mali Sud
PDESC	Programme de Développement Économique, Social et Culturel
PGRN	Projet de Gestion des Ressources Naturelles
PRMC	Programme de Réstructuration du Marché Céréalier
SAP	Structural Adjustment Program
PNUD	Programme des Nations Unies pour le Développement
SLA	Sustainable Livelihoods Approach

UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USAID/ARD	Partnership between USAID and ARD, Inc.
USD	United States Dollar
WASH	Water, sanitation, and hygiene
WATSAN	Water and sanitation (committee)
WB	World Bank
WRM	Water resource management
WV	World Vision

CHAPTER 1

INTRODUCTION

1.1 Water and global crises

There is no argument, water is a critical global resource. It is one of the key elements to human development and well-being, yet it is also one of the most poorly managed resources on earth. As demand continues to exceed supply, available freshwater is diminishing. The World Bank notes that at least 700 million people live in countries experiencing water stress or scarcity and by 2035, the number of people living in severely water stressed environments will increase to three billion.[1] With populations projected to increase by over 30% from 2010 to 2050, threats to economies and human health are imminent. Water withdrawals for combined agricultural and industrial uses will increase as production needs are met. These demands will be compounded by urbanization and development, raising individual water demands as standards of living improve.

In North America, water stresses are already apparent throughout the Canadian Prairies and southwestern United States. Critical water shortages continue to be forecasted along the Colorado River, causing water-related tensions between California and Arizona to be resolved by the courts (Wegner, 2010). Globally, the pressures surrounding water scarcity are expected to elevate existing conflict between upstream and downstream neighbors sharing water resources. Tensions remain high along the Euphrates and Tigris Rivers between Syria,

[1] Water resource management data available at http://www.worldbank.org/ (Accessed January 26, 2011).

Turkey, and Iraq in the Middle East. Concerns of poor water management and uncertain environmental conditions, further threaten already precarious political relationships (Kibaroglu, 2002). In Africa, the situation is dire between a number of countries sharing water along the Nile River basin, including the Democratic Republic of Congo, Sudan, Burundi, Uganda, Rwanda, Ethiopia, and Egypt. Many of these countries, as well as their neighbors, have a long history of water-related conflict, which is only expected to worsen as populations double in the region over the next quarter century (Beyene et al., 2010). Water is intrinsically linked to global crises of poverty, disease, climate change, and food security. As water resources become increasingly scarce from overuse and mismanagement, these crises will become amplified, leading to greater global political instability.

The issue of water and its sustainable management is also critical in the West African nation of Mali. Water moves through the country along the Niger River Delta, supporting thousands of communities dependent on seasonal water flows for smallholder farming and fishing. Recent agreements between the Malian government and foreign interests are threatening downstream populations with the drastic expansion of private, large-scale irrigated crop production. Farmers are concerned about contracts with countries such as Libya, which will lease vast expanses of land and divert valuable irrigation water for the next 50 years. While Libya and similar contract beneficiaries gain improved food security for their own populations, they will exploit the necessary water flows for subsistence farmers, reducing Mali's capacity for domestic agricultural production, and negatively impacting biodiversity in the region (Zoomers, 2010). Communities already facing water stresses due to environmental conditions will have everything to lose as water tables drop and the floodplains no longer

support their livelihoods. Other threats to Mali's water supplies include nitrate pollution from urban waste (BGS, 2002), as well as pesticide and fertilizer runoff (UNEP, 2010) and increasing groundwater salinization (BGS, 2002) from intensive agricultural practices. Surveys have shown that between 1950 and 1989, Mali has faced a downward trend of annual precipitation by 15 to 20% (Paturel et al., 2003). The same research showed that river water flows in the region have also declined by 30 to 50% over the past 40 years. Reduced rainfall and river volumes, along with increases in population and pollution, point to the larger-scale challenge of sustainable water management in Mali.

The current and looming threat of climate change further exacerbates food and water insecurity, compounding issues of scarcity with unpredictability. Based on historical records and climate modeling by the Intergovernmental Panel on Climate Change, it is difficult to know whether the current droughts in the Sahel are naturally cyclic or a result of climate change, or a combination of both (Collier et al., 2008). However, these climate models do identify a clear relationship between human activities and climate change more globally (IPCC, 2007), which are anticipated to impact Africa severely because of the continent's geography, agricultural dependence, and the challenges to adapt by diverse stakeholders in the region (Collier et al., 2008). The effects of climate change pose devastating consequences on rural households in sub-Saharan Africa with the persistence of extreme weather events and stresses on agricultural productivity (Shah et al., 2008). The negative impacts of climate change in countries like Mali exacerbate challenges to water provision and agriculture production, as desert boundaries spread (de Wit & Stankiewicz, 2006) across regions already facing environmental and economic vulnerability (Ludi, 2009), and low adaptive capacity (Boko et al., 2007; Adger, 2003). These challenges are expected to

elevate conflicts among pastoralists and cultivators along transboundary water systems, increase migration, and raise the risk of illnesses among water scarce populations (Urama & Ozor, 2010). The urgency of these uncertain events requires an adaptable, coordinated international approach to prevent regional devastation.

The United Nation's 3^{rd} World Water Report identifies the need for greater collective action in water resource management because of the inherent connection between water resources and sustainable, socioeconomic development (UNESCO, 2009). The report proposes a more holistic approach to water management in response to dynamic global conditions – both in our natural and social environments – to find the balance between short-term needs and long-term strategic development in the face of environmental limitations. In rural development efforts across the most resource-stressed regions, this balance is of utmost importance. Water management must be a key component of development assistance to respond not only to immediate global crises such as poverty and food security, but to plan for the changing needs of growing populations and future demands on our limited natural resources.

1.2 Collaborative water management and rural development

This study explores community-based water resource management in the context of development interventions. The example of water projects conducted between a well-established nongovernmental organization (NGO) and a number of rural communities is used to examine several factors influencing a desired outcome of such projects, the improved management of natural resources. Insti-

tutional (structural) and collaborative (behavioral) dimensions of these partnerships are explored to improve our understanding of key mechanisms by which community-based water resource management is most effective and even improved. Gender adds depth to the analysis to highlight the significantly different needs and opportunities of stakeholders in local water resource management. The concept of gender applied to this analysis is based on the work of social scientist Joan Scott. Scott describes gender as two distinct, yet interrelated parts where "... gender is a constitutive element of social relationships based on perceived differences between the sexes, and gender is a primary way of signifying relationships of power" (1986, p. 1067). Although gender is discussed in more detail in the following chapter, an early clarification of the use of gender in this research is warranted because the concept is so deeply contextualized depending on one's environment. Considering the dimensions of collaboration and gender together is key for two specific reasons: to delineate the institutions in place intended to facilitate local resource management in Mali, and to understand the nature of the relationships between stakeholders.

The concepts of participation, social learning, and social capital relate to the mechanisms in collaborative, gendered resource management. More specifically, they lend insight into the relationships between the variables of collaboration and gender with respect to community-based water resource management. In this research, the concepts of collaboration and gender are associated in the context of rural water projects as a system. Conceptualizing development projects as systems that influence the management of local resources is a practical way to consider impacts of development initiatives on rural livelihood security, while navigating the numerous components of these projects. The following discussion examines several case studies in rural water resource man-

agement to highlight multiple components of these complex systems as they relate to participatory development and the dimensions of collaboration and gender.

As development initiatives become increasingly participatory, opportunities in project management are placed in the hands of the communities where the projects are situated. Organizations or institutions implementing the project see participatory processes as an opportunity to promote capacity building within communities and individual households. Participation is intended to supersede top-down development initiatives and promote greater investment in human capital. In water resource management, a more inclusive environment is essential to better guide local decision-making (Isham & Kahkonen, 2002). The identification of existing supportive, reciprocal relationships, or social capital, in rural communities is central to provide opportunities for marginalized stakeholders in decision-making environments.

Collaborative development processes implemented to improve resource management require arenas for institutional transparency and accountability (Nelson & Agrawal, 2008). This is especially the case for rural communities with past histories of top-down participatory approaches employed by governments or outside development agencies. Without the capacities to control resources and plan for local needs, rural communities in developing countries are susceptible to succumbing to the *Tragedy of the Commons* (Hardin, 1968). As demonstrated in Mali, the exploitation of common property is a threat among households in rural communities, particularly among pastoralists where common pool regimes to manage shared resources do not offer flexibility for nomadic herders (Benjaminsen, 1997). Valuable natural resources such as water

will continue to be threatened by exploitation and environmental contamination without improved collaboration among communities, governments, and NGOs, who must work collectively to mitigate these costs. At least in the short-term, existing institutions and partnerships in Mali must better navigate the dynamic, complex systems of local natural resource management. Nobel Prize-winning economist Elinor Ostrom suggests common pool resources, such as water, are better managed by the resource users themselves using durable co-operative institutions built on trust and self-governance, than by government interventions or privatization alone (Ostrom, 1990). The relationships between all stakeholders, therefore, are a critical component of development projects.

1.2.1 Women in local water management

Water supply projects where women are included in all aspects of design and implementation are rare. However, numerous examples of projects exist, which identify significant gaps between men and women in decision-making with regards to resource management and rural development (Singh et al., 2005; Schneiderman & Reddock, 2004; Omer, 2003; Dube & Swatuk, 2002; Tapela, 2002; Regmi & Fawcett, 1999; Michael, 1998). As the main users of water resources in many rural communities worldwide, women are placed in traditional gender roles by cultural norms, often as subordinate to men, without consideration of both their strategic and practical needs (Regmi & Fawcett, 1999).

Some national and state governments publicly recognize the need to build capacities of women to engage in local natural resource management. However, gender inequities and cultural class divisions discourage capacity development

of women from actually happening at the grassroots level. In India, for example, the caste system adds an additional cultural element of complexity for female participation in resource management (Singh et al., 2005; James et al., 2002). During the siting of wells, access must be provided for lower caste women, not just for those of higher castes to facilitate water collection among a general population. Despite this obvious need, higher caste women tend to have better access to public water points as a result of their greater social and political clout in the planning processes. These social structures and power imbalances, even among the same gender, exclude a large portion of marginalized water users in rural communities. This ultimately places greater stress on the livelihoods of these particular individuals and their households, perpetuating imbedded social marginalization. The social and economic impacts of these relationships are well-documented in the literature on gender studies, particularly age and relation hierarchies between wives, daughters, widows, and elderly women (Cornwall, 2005; Dickerson-Putman & Brown, 1998).

Other social and cultural factors, such as language and education, play equally important roles in project success and sustainability. Interactions among community members, government administrators, and donors provide different opportunities and powers depending on the social organization of the communities and institutions. In Zimbabwe, language constituted a major source of power among stakeholders (Tapela, 2002). Rural persons who may speak only local dialects or who lack the same levels of education are often looked down upon by project administrators, even as their fellow nationals. With regards to water supply projects, these social constructs and perceived levels of power may significantly influence issues of access, distribution, and use of water resources within communities (Singh et al., 2005).

A South African case study suggested policy change at national and regional levels provides an avenue for gender equity in resource management (Schreiner et al., 2004). In this example, building new democratic institutions is believed necessary to bridge the gap between government support and local access to water and water-related infrastructures. Unfortunately, in regions where governments are putting extreme pressure to fast track new policies and management systems, the participatory processes of these newly implemented institutions are lost. In Zimbabwe, the process of decentralization continues to require coordination and commitment to legitimize power relationships and stakeholder participation, even years after the process began (Dube & Swatuk, 2002; Tapela, 2002).

Men's perceptions of changing gender roles in local water supply management are mixed. James et al. (2002) noted that some men saw women challenging male authority, causing increased household stress between husbands and wives. With improved access to water, some men felt that as women became less occupied with their domestic responsibilities (many of which revolve around the use of water), women would disrupt the social fabric of their households (Devasia, 1998). Despite this obvious notion of traditional gender norms and expectations, these articles also suggest that such notions can be transformed through education and cultural acceptance, generally improving local resource management. There are positive instances where opportunities for both women and men to participate in water supply projects enhance social and economic status in the community, but the actual incentive to participate is limited by the available resources and opportunities made to him or her (James et al., 2002; Cleaver, 1998). Improved status may be a secondary benefit of participation, particularly for resource-poor women; the driving factor for their inclusion can

be argued out of necessity for household survival (Rathgeber, 2003).

One of the main challenges for women in water supply management in rural communities, however, is time. Participatory processes require time free from daily domestic responsibilities, such as water collection, cooking, cleaning, child rearing, and agriculture. Without anyone to assist with these responsibilities while a woman attends committee or community meetings, the freedom to participate does little. As Regmi and Fawcett (1999) suggest, raising awareness in gender inequalities can shift social attitudes. With this shift in attitudes and increasing the discourse at the community level, men may gradually be encouraged to assist with some of the domestic responsibilities, freeing time for women to engage in other activities. This process is one that involves the commitment and coordination of all stakeholders in the development process. Even as government and NGOs incorporate gendered participation in development initiatives, community leadership and individual households must choose if, and how, they will transfer these shifting social norms into local decision-making. Special consideration must be made to promote behavior change among men in order for gendered social change to gain legitimacy at the community level (Welsh, 2010).

Showing that women can contribute to the economic activities of the household by gaining greater control of their resources, will further encourage women's participation in community planning and decision-making. Many development initiatives involve a variety of activities designed to improve quality of life for households, by considering this a component of broader development. For instance, the construction of a cereal storage center in a community may be complimented by additional projects, such as training men and women

in microcredit. This survey of the literature suggests the integration of income-generating activities and micro-enterprises may empower and improve the status of women, both socially and economically (Singh et al., 2005; James et al., 2002). Improving the status of women would lend to improved collective ownership and management of resources, increasing local investments in their sustainable use. However, development programs attempting to include women in the planning and management stages of water supply projects do not always incorporate appropriate opportunities for women to accrue household income.

As mentioned earlier, it is common for women to spend many hours with their responsibilities in child rearing, cleaning, agricultural labor, and water collection. Even when water collection technologies are improved or wells are installed closer to households, there are new impediments to income generation, just as there are to participation in local decision-making. One such problem is the increase in household water usage. As a result, the time saved from shorter distances to water points may translate into increased water usage. In communities facing water scarcity, increased usage could create conflict among households competing for shared resources without improved conservation efforts.

Another problem is that time saved from water collection is spent doing activities with minimal economic value (i.e., increased weaving or knitting for the household), which is often the result of misguided development projects (Regmi & Fawcett, 1999). Income-generating activities initiated through foreign development projects must recognize women's relative access to appropriate markets. Relevant training in accounting and management, as well as the sustainable procurement of tangible inputs and resources, are required to produce profitable items for sale in local markets. The promotion of activities leading

to greater household income must also be valued enough by the household to justify the reallocation of time and energy saved from water collection, which would otherwise go towards other domestic chores, such as taking care of children or collecting firewood. Time diverted from child care often has severe consequences on the nutritional status of young children that are life-long (Smith et al., 2003).

While we are learning that development projects often bring innovations, technologies, and new opportunities into regions of resource scarcity to improve livelihood security, we rarely take the time necessary to explore the unintended results of our actions. We often perceive our efforts in a manner not in line with the real impacts experienced by households and communities, perhaps this is in fear of losing funding or project commitment by stakeholders. However, assuming all *underdeveloped* communities would gladly welcome our interventions and notions of progress is unreasonable. Projects are not always designed to suit the needs and social organization in communities and households. More realistically, communities choose outside assistance due to a lack of options and an obligation to provide their households with basic resources, whether or not the assistance is the most appropriate alternative (Gleitsmann, 2005). To take these realities into consideration, the development assistance being discussed in the following research goes beyond the provision of physical infrastructure, such as a water pump or well. It also includes institutional infrastructure – the approaches used by community development partners including the government and NGOs, and the relationships between all stakeholders in local resource management.

1.2.2 Linking international development with local resource management

These issues faced in water projects between governments, NGOs, and rural communities lead to a broader discussion of the changing discourses in development. The concept of international development is complicated – it has numerous meanings, intentions, and implications depending on who is participating in the process and how their involvement is perceived. For the majority of the earth's population, however, the word *development* is a reminder that they are in an undesirable condition, which requires the help of others to escape (Esteva, 1991). On the African continent, discussing development is difficult without considering the role of early slave traders, colonialism, and the spread of post-war era economic and social institutionalization. Prior to these global interventions, the African economy and society functioned on the basis of unity; livelihoods were based on kinship and spirituality rather than capitalistic gain. This is not to say communities did not face considerable competition, discrimination, and often violence over resources, but colonial rule added another dimension of exploitation. For Africa, this may have led to a slower pace of development in the Western understanding of the word, but can nonetheless be considered progress (Cooper, 1997).

When Africa was colonized, this progress was interrupted.[2] Struggling with their own ability to progress in modernity, colonizing powers such as Britain and France saw an economic opportunity to exploit the human and natural resources of these nations to feed their own industrial and economic revolutions

[2]It can be argued that the start of slavery in the 15^{th} and 16^{th} centuries by European traders was one of the first impediments for African progress. Although an important note historically, the social complexities of slavery are not explored further in this analysis.

back home. According to the West, social, economic, and political progress was never thought to have existed in Africa. The West defined itself as the ultimate model of modernity and measured others as subordinate, creating a theological tool to support Western imperialism (Cooper, 1997; Marglin, 1990). Until independence was sought by African nations in the 20^{th} century, this ignorance about the notions of varying degrees of progress occurring around the world carried on, but not without serious complications (Sylvester, 2006).

For most European rulers, colonizing Africa came down to two fundamental benefits: access to bountiful resources and a broadened reach of power. Colonialism introduced new pressures on natural resources, a restructuring of communities, labor forces, and migration, as well as increased militaries and new means of destruction. The Western definition and manipulation of progress changed the course of African society. By the 1940s, colonizers saw that production for their empires was slowing and tensions in labor forces were increasing. As Cooper (1997) described, "... development ideology was originally supposed to sustain empire, not facilitate the transfer of power," but pressures from the colonies led to a slow realization that production for the benefit of the West was dependent on the health of the colonies. Some colonialists suggested this would be possible through sovereignty and improved access to the global markets. In a sense, "... development was supposed to re-establish imperial control over the agenda of government in the post-war era" (Cooper, 1997). What we now see are new challenges to these nations who have been forced into a global political economy after having their natural paths of regional progress changed through colonialism. Other factors, such as the continent's natural environment, population dynamics, recurring conflict, and poor governance, have added to the challenges faced in Africa's development (Bates, 2008; Collier, 2007; Diamond,

1999; Bloom et al., 1998).

The construct of social, political, and economic inferiority is a troublesome component of development rooted in the history of colonialism. Thirty years since the last African country gained independence from European colonial rule, much of the continent is still burdened with feeble agricultural growth, reductions in industrial productivity and export performance, rising external debt, and declining social indicators. Colonialism has complicated our understanding of progress and development. It has created what we now know as the *Third World* – societies of revised nation-states pushed awkwardly from the Western economies they were once manipulated to support (Davis, 2002; Washbrook, 1997).

Development practitioners, economists, and historians alike are starting to see that the turn development took over the past 50 years with regards to impacting Third World populations "... was basically the wrong answer for their true needs and aspirations" (Rahnema, 1997, p. 379). Now, the shift to post-development begins with a significant change in discourse. The meanings we take for granted to understand the contrasts between the *developed and underdeveloped*, the *rich and the poor*, the *modern and traditional* are no longer sufficient.

Although scholars of development studies tackle issues of poverty and resource distribution, they fail in breaking the stronghold on the modern versus the traditional. It is a field that has typified regions based on levels of modernity relative to the West and has validated dependency, modernization, and neo-liberal agendas for much of its history through power imbalances (Escobar, 1997). Therefore, the discussion around development highlights the importance of distinguishing the effects of colonialism/decolonization as well as the

inclusion of marginalized populations, or the *subaltern* (Spivak, 1988), in a new development discourse.

From planning and decision-making to construction and monitoring, women continue to be excluded from development processes (Goetz, 2002; Agarwal, 2001). Representation at institutional and community levels remains a significant hindrance to gender equality in resource management. When women do play an active role at the community level, government policy lacks the thrust necessary to change government-controlled programs to better suit the needs of the community water users, particularly women (Schneiderman & Reddock, 2004; Tapela, 2002). The new post-development discourse is thus one of environmental sustainability, gender equity, and human development (Sen, 2001; Rahnema, 1997; Sutcliffe, 1995; Elson, 1991). With the field of international development so deeply imbedded in debates of equality and progress, it is not surprising to see natural resource management at the center of this discourse (Woodhouse & Chimhowu, 2005). Although these concepts are not new, they have not been united in the debate about development until recently – the unity of redistribution and recognition – the restructuring of political-economic injustices along with cultural and symbolic change (Fraser, 1997). Through the integration of these concepts in the evolving development discourse, desirable outcomes such as improved resource management may be achieved.

1.2.3 Global partnership in rural development

Global partnerships, such as the West Africa Water Initiative (WAWI), are well-situated to bring together issues of gender and resource management in

the context of collaborative rural development. WAWI functions in three partner nations (Ghana, Mali, and Niger) through its ability to provide strong financial backing and diverse expertise, and its ability to establish a presence in rural communities. Despite these apparent advantages, WAWI projects remain susceptible to challenges, and at times, failure. This research explores the range of stakeholders in water projects implemented by WAWI to improve water resources in south-central Mali. The analysis identifies a number of challenges and limitations experienced by project partners, including local water users.

1.3 Purpose and research questions

This research explores impacts of development programs on rural livelihood security in Mali in the *Cercle de San, Région de Ségou* (Figure 1.1). Over the past 30 years, hundreds of communities in rural Mali have experienced some type of outside intervention through development programs. Projects have ranged from the provision of water supplies to HIV/AIDS education. Using the presence of the West Africa Water Initiative (WAWI) in rural Mali as a platform for exploration, four core areas of focus are considered in this research: 1) the historical context of water resource management, 2) perceptions of development projects by diverse stakeholders, 3) impacts of intervention design on rural households, and 4) the role of gender in these development projects. These research elements provide the basis to understand how considerations of collaboration and gender may lead to improved water resource management as promoted through rural development projects.

Considerable research has been conducted in the region focusing on local re-

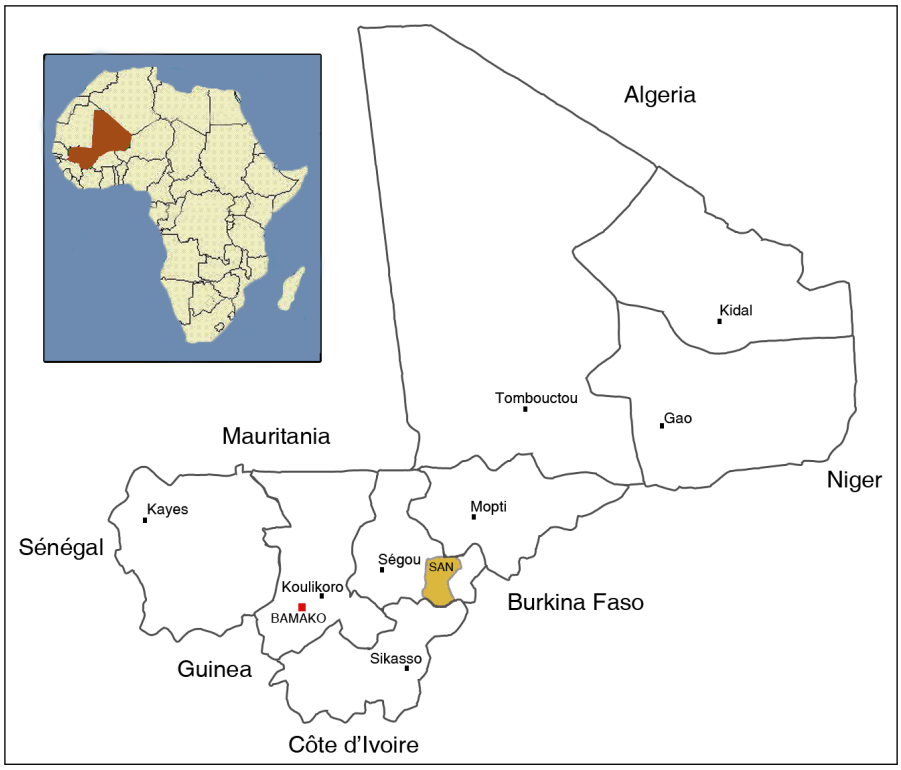


Figure 1.1: *Cercle de San, Région de Ségou* [Mali]

source management (Onibon et al., 1999; Norman, 1997; Ribot, 1996). A number of studies have specifically examined water supply and agricultural sustainability (Klaartje et al., 2007, 2006; Gleitsmann, 2005; Bontkes & Keulen, 2003; Coulibaly, 1995). Many of these studies focus on either the core institutions implementing the projects or the water users as recipients of water infrastructure. The research described in this study differs as it considers both groups of stakeholders. A careful examination of the effects of development in communities using the narratives of individual households is complimented by a broader analysis to look at the system of local resource management though development interventions.

There is little argument that in Mali, foreign- and state-funded development projects are an essential means of improving the provision of water for many

resource-poor communities. Since the country is reported to have plentiful water supplies, the issue is a matter of increasing access to safe, sustainable water resources. The provision of safe water has become a critical component of broader livelihood development goals (UN, 2010).

According to Earthtrends (2003), Mali has combined surface and groundwater supplies of 4,992 m^3 per capita. This is much higher than the minimum livelihood threshold of 1,700 m^3 per person, identified by Falkenmark and Widtrand (1992), but does not reflect the logistical challenges of water provision in a country such as Mali. Additionally, per capita water supplies are projected to decrease to 3,263 m^3 between 1990 and 2020, reflecting a 52% decline in available freshwater (N'Djim & Bakary, 1996). Although freshwater sources are plentiful (Figure 1.2), the country faces a multitude of social, political, environmental, and economic constraints to the provision of safe, sustainable water supplies, particularly to its rural communities. Access to water is most limited by the country's widely variable temporal and geological conditions (N'Djim & Bakary, 1996). In fact, some of Mali's most densely populated areas, including Bamako and Koulikoro, are located in a region with extremely poor aquifers having limited viability (BGS, 2002).

The Water Poverty Index (WPI), measuring the impact of water scarcity and water provision on human populations, reflects this dilemma. A lower WPI score shows significant water scarcity and poor water provision. Analyzed on five major component indices including resources, access, capacity, use, and environment, Mali has a relatively low WPI compared to a selection of countries with less available water (Table 1.1). Mali's WPI reflects the average rural household's limited access to resources and the country's unsustainable management

of water resources. Approximately 50% of Mali's nearly 14 million inhabitants do not have sustainable access to an improved water source and 54% are without improved sanitation (UNDP, 2007/2008).

Table 1.1: Water poverty indices for Mali and selected countries

Country	WPI
Niger	35
Mali	***41***
Ghana	45
Bangladesh	54
USA	65
United Kingdom	72

[Source: Earthtrends (2003)]

Although water projects are essential to improve access to water resources in rural communities throughout Mali, the sustainability of these projects is not necessarily realized. The nature of the collaborations and the role of individual

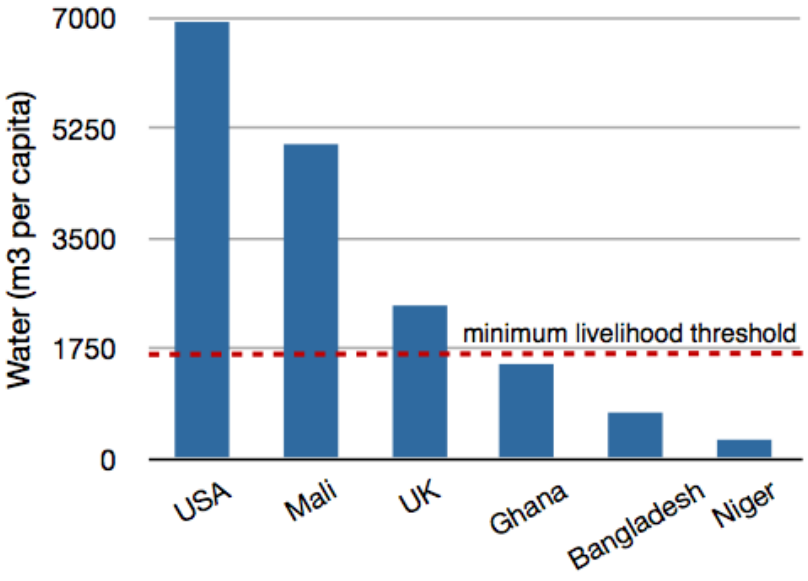


Figure 1.2: Internal renewable water resources per capita [Source: Earthtrends (2003)]

water users, specifically women, must be clearly understood to design initiatives to suit the needs of individual communities.

While focusing on the implementation of development initiatives promoting local water resource management, this study examines four questions.

1. **What is the evolution of water resource management in rural south-central Mali?** This question was explored by conducting an inventory of historical water resource management in the study communities. This provided an understanding of the experiences of these communities, both through the West Africa Water Initiative (WAWI) projects led by World Vision (WV), which are referred to as WAWI-WV from this point forward, as well as through earlier water management efforts.
2. **What constitutes a viable intervention in water resource management?** This question identified what ingredients make a development project a positive experience in a rural community, allowing for longevity and commitment by local stakeholders.
3. **Do local experiences with WAWI-WV projects lead to changes in patterns of water resource use, changes in the ways individuals interact within the community, or other unintended consequences of intervention design?** This question attempted to determine how water projects affect local livelihoods and household security including social networks and changes in resource management, in ways other than what they were intended to do (i.e., simply to establish a water supply for a community).
4. **How do men and women perceive their roles in decision-making in a collaboration model as exemplified by WAWI's projects in local water resource management?** The final question examined what participation in

decision-making processes means to individuals in the community, specifically for women in water resource management. Both the provision of forums for inclusion, as well as feelings and use of opportunities influencing participation, were examined.

Development has a tremendous impact on rural livelihoods and resources. Impacts of development interventions can be extremely positive, but may also negatively influence the social constructs of rural communities. The experiences and perceptions of local communities involved in the WAWI collaboration were examined to investigate the four questions presented above, by exploring the structural and behavioral mechanisms within development projects at the local level.

As will be described in the following chapter, the structural analysis focuses on the institutional mechanisms enabling men and women to exercise rights to decision-making processes and achieve forms of effective participation. The behavioral analysis examines the mechanisms influencing individuals' perceptions of outside development and how opportunities are used to improve access to natural resource management.

Together, the analyses help to understand the effects of intervention design. In this study, the example of water supply provision by development agencies is used to explore impacts of resource management interventions, in particular the changes in access to participation, relationships between stakeholders, and behavior change. The analysis also approaches water management from the perspective of household usage – the use of water by a household to support daily water needs including drinking, bathing, cleaning, feeding animals, building houses, and supporting smallholder gardens. While focusing on both individ-

ual water users and the household as units of study, the larger context of water need and usage is also considered as a system of water resource management impacting overall livelihood security. It is recognized in this study that using the household as a unit of analysis has limitations. For this reason, the varied experiences and perceptions of individuals within these households is essential to account for the "conflicting nature of the relations" influencing production, consumption, and reproduction with a household (Benería, 1981). These perspectives reveal vital aspects of household security in this study, such as livestock holdings and land use, which depend on sustainable water resources.

Exploring perceptions of development from the viewpoints of local actors provides an understanding of the function of collaborations and gender in projects at the community level. This is done by examining the evolution of gender sensitivity in project design, and its perceived ability to improve access to decision-making, in community-based natural resource management. It was essential to reflect on the effectiveness of these diverse partnerships acting locally in terms of long-term sustainability, and most importantly, their impact on rural livelihoods in developing countries. A summary of the research framework is provided in Table 1.2

Table 1.2: Research framework

Research Element	Hypotheses	Research Indicators	Method of Verification	Assumptions
Historical water use and management (question 1)	Resource management historically controlled by traditional leaders Livelihoods greatly impacted by environmental factors Decentralization processes create new opportunities for outside intervention by NGOs in rural communities	Consistency of historical recollections of local resource availability, use and management Roles and responsibilities of government, NGOs, and local communities in local resource management	Historical accounts of water use and management by traditional leaders and households through semi-structure interviews and group discussions Historical climate data Presence of development projects/partners in communities Semi-structured interviews with government and NGOs	Historical documentation may be limited The *griot* (system of passing along history) and village elders may hold majority of local knowledge, backed-up by household knowledge of historical events Mayors' offices may only hold more recent records because of new role in decentralization

Table 1.2: (Continued)

Research Element	Hypotheses	Research Indicators	Method of Verification	Assumptions
Perceptions and experiences with development projects (question 2)	For those with greater inclusion throughout project design, management, and implementation, perceptions will be more positive Varying degrees of social capital influence perceptions of outsiders (see following two points) A lack of ownership in a project will lead to a lack of trust and negative perceptions Communities with poor past experiences are more likely to be wary of outsiders Relationships that are built early on and maintained throughout a project result in positive perceptions ones that are carried on through future projects Outside project collaborators who have invested more time in a community will evoke a more positive perception Long-term commitments with communities results in more positive perceptions Perceptions of project partners differ depending on type of partner (government vs non-government, Western vs national/local) Cooperative collaboration between outside agencies will promote a positive presence within a community	Number of different outside agencies who have worked on development projects in community Number of different outside agencies who have worked on development projects in community on consistent basis Duration of projects in communities (or relationships with) Attitudes towards new development projects in community Attitudes towards ongoing development projects Willingness of community members to participate in development projects	Historical records of development activities in village (WV and other local NGOs) Semi-structured interviews with local government agencies, NGOs, WAWI partners, and WV field agents Direct observation within community Interviews with village councils/ *chefs de village*/ *chefs de terre* Semi-structured interviews within community Focus group sessions in community Mapping exercises Ranking exercises	Not all communities (or individuals) are the same; although general assumptions may be made, it is dangerous and naive to assume homogenous Focus on NRM projects; results may follow a trend for other types of outside involvement (it is not the project itself, it is the experience with the participants in the project) WAWI is not representative of all collaborations

Table 1.2: (Continued)

Research Element	Hypotheses	Research Indicators	Method of Verification	Assumptions
Impacts of outside intervention (question 3)	Collaborative development is not uniform and different stakeholders have different access to resources and decision-making Intervention design does not always have a positive impact on livelihoods Using the locations of boreholes as an example, changing the patterns and forms of resource acquisition will alter livelihoods in both positive and negative ways Social learning is affected by intervention design – individuals adapt and alter their modes of daily survival accordingly	Changes in water collection points Amount of time spent with other women changed (time previously spent together collecting water) Available capital among households Types of coping mechanisms for livelihood security Changing daily roles and responsibilities of women and children (labor requirements inside and outside of household) Changing attitudes towards these roles	Mapping of water collections points (WV) Review of historical records (WV) Interviews with village councils/ *chefs de village*/ *chefs de terre* Direct observation within community Semi-structured interviews within community Focus group sessions in community	With openness, trust can be established with members of the community, resulting in honest and candid discussions Depending on the community and individuals, perceptions will vary Tones and reactions during discussions will imply an honest sense of individual perceptions Historically, women and children spend a significant amount of time collecting water each day

Table 1.2: (Continued)

Research Element	Hypotheses	Research Indicators	Method of Verification	Assumptions
Role of gender in local NRM development projects (question 4)	Development collaborations may promote gender mainstreaming in policy, but practice in the field is often superficial When women are given opportunities to participate in local NRM, participation is not authentic and is not available to the majority of resource users Authentic participation of women leads to improved NRM Men perceive their responsibilities in local NRM much differently than women	Number of men and women on local water committees Types of men and women on these committees (representative of average community water user) Changes in local NRM initiatives Changes in economic opportunities	Direct observation within community Semi-structured interviews within community Focus group sessions in community Role playing with women Group discussions with women and men separately Ranking exercises Mapping exercises Semi-structured interviews with village councils/ *chefs de village*/ *chefs de terre*	Social stratification of men and women in rural villages is not monolithic Women are primary users of local water resources but have little participation in decision-making processes to manage these resources Improved NRM leads to sustainable (if not increased) economic opportunities Women will not have a significant amount of time available for individual interviews or group discussions and data collection tools must accommodate accordingly

CHAPTER 2

CONTEXTUAL FRAMEWORK

This chapter presents the contextual background and conceptual basis for the research. An overview of the WAWI partnership and general state of development in Mali is intended to contextualize the implementation of water projects in rural Mali. The concepts of collaboration, gender, participation, social capital, and social learning are introduced to establish a conceptual framework for the research and analysis.

2.1 Collaboration in the West Africa Water Initiative

The year 2002 marked an important milestone in the global initiative to improve the livelihoods of rural poor around the world. The United Nations World Summit on Sustainable Development in Johannesburg led to the creation of the Millennium Development Goals. In addition to supporting poverty eradication, disarmament, and human rights, one of the main mandates of the UN declaration was to halve the proportion of people without access to clean drinking water by 2015.[1] Shortly after the Millennium Development Goals were established, the West Africa Water Initiative (WAWI) was formalized by a group of international collaborators to focus on the link between water and human health in sub-Saharan Africa.

This global partnership has been working to both foster collaborations between institutions and improve community capacities to access safe drinking water, promote hygiene and sanitation, and adapt sustainable resource man-

[1]Information regarding the UN Millennium Development Goals is available at http://www.un.org/millenniumgoals (Accessed June 18, 2011).

agement practices. The initial six-year phase of the project conducted activities in rural and peri-urban areas of Ghana, Mali, and Niger. The focus of this research is based on WAWI activities in Mali, a country listed as one of the least developed on the UN Human Development Index[2] and a region facing recurring periods of extreme drought and severe flooding along the Niger River.

The WAWI partnership specified four program objectives to define the context of its work in West Africa. The objectives of the WAWI collaboration include increasing access to water, reducing the occurrence of waterborne diseases, improving sustainable management of water resources, and developing models of partnership and institutional synergy. WAWI is just one example of the many types of development initiatives. What makes WAWI an exceptional model to explore is twofold: the partnership is committed to longer-term goals in partner countries, and the partnership itself is highly multidisciplinary and complex, yet with projects targeting many of the fundamental issues in development worldwide.[3] Many of the WAWI partners in Mali have been working in the region for much longer than the lifetime of this particular formal collaboration.

2.2 The context of development in Mali

A review of the social demography in Mali, highlighting the well-being of women in the country as well as the current political push for decentralization, is useful to frame this research. Establishing the context of development in

[2]Ranked 160 of 169 countries on the UN Human Development Index (UNDP, 2010).

[3]Phase I of WAWI was completed over a six-year period. The program was initiated in September 2002 and the first phase of the project ended in December 2008, which was followed by a transition period. Phase II continued in late 2009 after a partner-wide evaluation of project achievements, resource requirements, future funding, and an evaluation of stakeholder community needs.

Mali draws attention to some of the challenges of development processes and attempts to address them.

Mali is a landlocked republic nearly twice the size of Texas with a population approaching 14 million, half of whom is under the age of 15.[4] The population of the capital city, Bamako, is reaching 1.7 million inhabitants yet the majority of Malians live in rural areas. The national population growth rate is estimated between 2.4 to 2.7%. Before starting their own families, women begin contributing to the daily household needs at a very early age. An astounding 73% of women never attend primary school after the age of six, accounting for the low adult female literacy rate of 17% (literacy for men compares at 32%). Illiteracy rates are much higher in rural areas, as well as among older populations.[5]

USAID-funded demographic surveys performed in 2001 and 2006 provide revealing statistics on women's livelihoods in Mali.[6] Nearly two-thirds of women have given birth to their first child by the age of 19, and during their lifetimes give birth to at least six children. Women from rural areas generally give birth to more children than women in the capital, Bamako (average of 7.2 versus 4.8), which is attributed to a higher access to education for women in urban settings. Infant mortality remains high in the country where 190 out of 1000 children die before their fifth birthday, although this number has decreased from 229 between 2001 to 2006. Maternal mortality is likewise high in the region as one in 24 women have the risk of dying during their reproductive years. The

[4]Population data for Mali from the UN Department of Economic and Social Affairs Population Division are available at http://www.un.org/esa/population/publications/ countryprofile/mali.pdf. (Accessed November 10, 2010).

[5]The illiteracy rate is noticeable higher (80%) in the Mopti region of south-central Mali where WAWI conducts many of its initiatives than other regions. The rate in Ségou was 74.3%.

[6]All household demographic data were collected from www.statcompiler.com, a USAID-funded database of demographic and household data from developing countries worldwide. The statcompiler survey data used in this proposal were collected in 2001 and 2006. (Accessed December 5, 2010).

UN reports nearly one in 100 women die from pregnancy-related causes. For women between the ages of 25 and 49 at the time of the survey, half had entered marriage by the age of 16.5 years.

Approximately 74% of women are employed in some form of income-generating economic activity. Of these women, 66% are self-employed and earn cash. A large portion of the women surveyed indicated they have a direct say in how their own earnings are used, most of which contribute to overall household earnings. When asked specifically about their roles in general household decision-making, women indicated that most decisions on health care, large purchases, daily purchases, and family visits were made by men (ranging between 60 and 75%). This decision-making freedom was similar for women not in marital relationships, although slightly more restricted. For unmarried women, someone else (assuming a relative for most cases) made the majority of the same decisions.

The influence of women in the household, however, should not be discounted. Harris (2006) suggests that Malian women are more powerful than norms imply, but public discourse is limiting their ability to exercise their power. Public discourse, through socially accepted norms and behaviors, suggests that men are superior to women and thus have a greater capacity to govern local issues. For example, although women play an integral role in the collection of water for domestic and agricultural purposes in Mali, they have not traditionally had the ability to effectively contribute to local decisions on the allocation, sustainable use, and management of such resources. Gender aside, local inhabitants as a whole have had minimal opportunities to participate in the decision-making processes to find sustainable solutions to local water scarcity problems

(Gleitsmann, 2005).

Results from the WAWI mid-term review indicated the need for a collaborative push to further the involvement of women in local resource management. The review suggested that although both women and men have been increasingly involved in shared decision-making capacities (e.g., water and sanitation committees), women's participation is still lagging (ARD/USAID, 2007). The study by Gleitsmann (2005) identified similar conclusions. But women's involvement in resource management in Mali is complicated. Participation is affected by imbedded religious and social norms down to the household level, which are coming into conflict with development and decentralization policies.

At the macro-scale, decentralization is playing an integral role in rural development, changing the way local communities devolve authority. Development programs often accelerate this process for political and economic reasons. International lending institutions and donors, such as the World Bank (WB) and the International Monetary Fund (IMF), are considered the greatest proponents of decentralization as contingencies within their structural adjustment programs to promote democratization. The devolution of state powers over the past 15 years in Mali has meant that new local institutions are evolving in areas with long histories of strong local, traditional governance. With the changes in national and local governance, there also has been a rapid influx of development agencies in the country to, at least in theory, aid the government in achieving basic state development initiatives.

Mali had nearly 600 registered local, national, and international development organizations as of 2010.[7] There are at least 40 different development or-

[7]Data were obtained online at http://www.devdir.org (Accessed November 19, 2010).

ganizations involved in the WAWI collaboration in Mali alone, including core partners and local agencies collaborating at the urban and rural village levels. Considerable efforts across the country are being made to improve the security of rural livelihoods by providing basic access to water, health and sanitation, economic opportunities, and agricultural sustainability.

The ways in which organizations and individuals engage in the development process are variable and complicated. Understanding the extent to which these complexities shape collaborative, gendered development projects and their subsequent impact on the management of natural resources is relevant for development practitioners. An understanding of the system at play facilitates the design, evaluation, reflection, and redesign of development initiatives.

2.3 Conceptual framework

The research examines how the WAWI collaboration is intended to improve local water management in Mali, focusing on the shared use of boreholes and wells among residents of rural communities. To achieve this, the analysis is centered around two dimensions – structural (institutional) and behavioral (collaborative) – to identify the mechanisms that facilitate and even improve local resource management.

2.3.1 Structural and behavioral mechanisms

The structural mechanisms, or the structure of partnerships in development, are explored through an analysis of the types of partnerships and their support-

ing policy structures, stages of their development, the degrees of participation, and the perceived costs/benefits of maintaining these relationships. Reflecting on the past development programs and current activities conducted within the WAWI collaboration, the defined roles and responsibilities of each stakeholder are established. These roles and responsibilities provide insight into the institutional cultures among organizations and relationships among participants in WAWI programs. They also identify challenges and unexpected outcomes of the development process.

The behavioral mechanisms go hand-in-hand with the structure of development partnerships. These are explored through individuals' understandings, perceptions, and use of opportunities. Culturally nuanced sets of norms and behaviors shed light on the ways participants acquire and use knowledge to improve well-being (in this case, through resource management) and to understand how they perceive outside intervention.

Table 2.1 specifies key behavioral and structural mechanisms considered in this analysis with respect to the supporting dimensions of collaboration and gender, as well as key concepts in the context of rural development including participation, social capital, and social learning. These mechanisms are the basis of exploring local perceptions, consequences of intervention design, and authenticity of user-centered participation in local resource management in the following analysis.

Table 2.1: Structural and behavioral mechanisms

Dimension\Variable	Behavioral Mechanisms	Structural Mechanisms
Collaboration	Reinforcement of cooperation through discourse and actions	Shared goals among project stakeholders (verified by policy)
	Perceived values of collaboration	Systems in place for collaborators to coordinate and exchange knowledge
Gender	Views/attitudes of gender equality within community	Gender mainstreaming initiatives by project stakeholders (policy)
	Use of opportunities by women	Formal efforts by community to promote equity
Participation	Desire to participate	Policy promoting access to decision-making throughout project design, implementation, management, and evaluation
	Awareness of roles	Ability to participate (access to project, time, resources)
		Use of traditional local organizations
Social capital	Desires by individuals and communities to participate	Social networks within communities
	Changes in social capital/networks through experiences with projects	Collaborators use of existing social networks and traditional organization
Social learning	Influence of local leadership and peers	Use of traditional knowledge by collaborators
	Imbedded norms and behaviors among communities and development partners	
	Reactions to past experiences with development projects	

These mechanisms can be better understood framed by core concepts of development. Five of these concepts explored in the context of water development initiatives are collaboration, gender, participation, social capital, and social learning (Figure 2.1). As discussed in Section 1.2, the dimensions of collaboration and gender delineate the institutions supporting local water management in the *Cercle de San*, and explore the nature of the relationships between stakeholders. The remaining concepts relate to collaborative, gendered resource management and lend additional insight into how these two particular dimensions may lead to improved water resource management as facilitated through

community-based development initiatives. These five concepts as defined in the research are described below.

Figure 2.1: Relationships between research variables and key mechanisms improving water management in the context of rural development projects

2.3.2 Collaboration

In natural resource management, groups with divergent interests must work together with the shared goal of "... understanding and manipulating complex systems containing both human and natural components" (Blumenthal & Jannink, 2000). In this research, collaboration is defined as this process of working together in the context of improving water resource management. Collaboration is a dynamic process involving a group of participants with shared objectives working towards a sense of commitment and a need for a mutually beneficial resolution. Collaboration generally involves groups of individuals with complementary and diverse skills or knowledge. Ideally, collaboration is conducted with appreciative inquiry (Cooperrider & Whitney, 1999) and a mutual respect among all stakeholders. Collaborators are further defined in this study as cross-

sectoral (providing diverse expertise or resources) and international in locality. Collaborations may occur between combinations of community leadership and residents, donors, NGOs, and governments of different administrative levels.

An evaluation of the levels and kinds of participation (defined below) employed in collaborative projects can offer insight into the relationships between organizations and among stakeholders in the development process. Understanding the dynamics of these relationships is critical in order to appreciate how organizations can work together to achieve development objectives. The nature of these relations is affected by numerous factors. Government policies and NGO development initiatives often driven by external funding interact with the cultural and socio-economic complexities of rural communities creating diverse forms of collaboration. Some of this collaboration leans towards the lines of authoritarian, where the relations among collaborators are not equal. Others provide communities with the ability to problem-solve and make decisions for long-term sustainability. The structural and behavioral mechanisms present in the collaborative processes to improve natural resource management are important as they provide insight into the formation and functionality of participatory processes between all stakeholders in development.

2.3.3 Gender

Issues of women's equality have been associated with the development discourse for many years and the concept of gender has become increasingly institutionalized. Since the acceptance of the term in development discourse, most notably with the UN's Beijing conference in 1995, the concept of gender and its

role in development has sometimes become ambiguous. Gender is a socially constructed concept. It refers to those behaviors that define individuals as male or female in particular social and cultural contexts (Charles, 2006). Although the development discourse regarding gender tends to focus on the limitations faced by females, the role of men in local institutions, state apparatus, and international agencies is important throughout this analysis. The evidence of power imbalances, objectification, and demeaning behaviors differentiating the status of men and women is prevalent around the world to the detriment of many women. In Malian society, male dominance is openly accepted (Harris, 2006).[8]

Elson (1991) suggests breaking down the pleasantries and opening the discussion to the fundamental problems surrounding male bias in the development process. Male bias in policy is one of the root causes of gender inequities in development and can be demonstrated by examining a fundamental basis of well-being – the household. A common underlying component of many economic theoretical frameworks is the use of households as single units of analysis. As Elson points out, development objectives implemented on a household level "... assumed that resources targeted men (and) would equally benefit dependent women and children" (1991, p. 12). Such male bias by policy-makers discounts the complex social and economic arrangements in numerous households around the developing world. Using the example of male perceptions around women's poor participation in village meetings in Tanzania shows how relationships in the household typify such bias. The men attribute women's lack of participation to ignorance, disinterest, and their understanding (acceptance) of these meetings as an androcentric endeavor.

[8]There are some exceptions given the gerontocratic nature of Malian society. Women tend to gain power as they grow older, provided they have been married and have not divorced. Mothers also usually maintain power over their adult sons.

Because men have generally played a more dominant role in decision-making, they must also be engaged in changing the power dynamics influencing the participation of women. Regardless of this consideration, development projects often continue to focus solely on women's inequity and social exclusion when incorporating gender-sensitive program initiatives. And although many national and state governments publicly recognize the need to build the capacities of women in local natural resource management, gender inequities and cultural class divisions discourage this from actually happening at the local levels.

Although negative perceptions about mainstreaming gender have emphasized gender as a distraction by shifting the discourse on women's inequality back to men (Baden & Goetz, 1998), the purpose of including the dimension of gender in this analysis is not to prove or disprove these arguments or to rethink the positions of gender and development.[9] The aim rather is to highlight the presence of gender-sensitive development projects and to evaluate the modes and degrees of participation actually realized by women in collaborative water resource management.

[9]While men are also being neglected or adversely affected by various development programs, traditionally, women have been excluded in greater forms of decision-making processes at various stages of project planning, implementation and evaluation. During the collection of articles for this analysis, no studies were found focusing on a lack or ineffective forms of male participation suggesting that either men have far greater opportunities to participate in these forums or that the concept of 'gender' in development is highly feminized. It would be naive to ignore the power imbalances that prevent some males from participating with other males in decision-making processes.

2.3.4 Participation

Participation can be described as an interaction of systems to produce a co-ordinated action.[10] Popular development discourse suggests participation can create an atmosphere of transparency and accountability and instill a sense of ownership of a project. Majid Rahnema (1991, p. 121) suggests participation is justified because it "... expresses not only the will of the majority of people, but also it is the only way for them to ensure that the important moral, humanitarian, social, cultural, and economic objectives of a more humane and effective development can be peacefully attained."[11]

In dynamic processes, like collaboration, the levels of participation can change over the life of a project. Different stakeholders in a development project may share very different understandings and expectations for the degrees of participation employed by individuals, making a true coordinated effort more complicated. In her 1969 article, Sherry Arnstein (1969) illustrates this point with the "ladder of citizen participation." She described a typology of eight different levels of participation ranging from manipulation to maximum local decision-making capacity. Models such as Biggs' (1989) consideration of contractual to collegial levels of farmer participation and Chase et al.'s (2000) expert-authority to co-management analysis in natural resource management also offer useful tools to help understand modes of participation in the development framework. However, both provide only minimal account for the practical and strategic needs of women in resource management (Regmi & Fawcett,

[10]The Oxford English Dictionary defines participation as: "The action or fact of having or forming part of something; the sharing of something."

[11]A number of powerful arguments against the authenticity of participation and encouraging the reader to question its motives and implementation to improve processes of development are provided in *Participation: The new tyranny?* (Cooke & Kothari, 2001).

1999). Sustaining the basic human need for water, as well as building the capacities of women to improve access to and management of quality water resources, together account for the livelihood needs of women.

To achieve participation alongside issues of empowerment, the element of reciprocity must also be considered (Wilmsen, 2006). Going hand in hand with participation, reciprocity allows for the mutual exchange of knowledge and resources creating a truly collaborative environment. Together, these two elements allow the various stakeholders to see and gain value in the development process, making it mutually beneficial rather than one-sided and extractive.

Regardless of the nature of the project and the social or economic complexities faced by participants, authentic participatory development within rural communities includes the following objectives, as gathered from a wide survey of literature on participation:

1. Create an appropriate environment for the exchange of ideas and experiences by all groups in the community, including marginalized groups such as women and resource-poor.
2. Recognize and prioritize resource-related problems in rural communities.
3. Increase local decision-making and problem-solving capacities.
4. Utilize human and natural resources more effectively for long-term, sustainable management.
5. Promote environmental sustainability.
6. Change the attitudes and policies within traditionally top-down institutional bureaucracies to facilitate participatory development.

7. Create an exchange between all stakeholders that builds an environment of accountability and trust for economic, social, and environmental sustainability.

The working definition of participation used in this research is drawn from an earlier definition by social scientists John M. Cohen and Norman Uphoff, which was instrumental in framing the various stages of participation in development projects. Cohen and Uphoff (1977, p. 6) define participation as follows: "With regard to rural development ... participation includes people's involvement in decision-making processes about what would be done and how; their involvement in implementing programs and decisions by contributing various resources or cooperating in specific organizations or activities; their sharing in the benefits of development programs; and/or their involvement in efforts to evaluate such programs." They go on to later clarify that participation should be regarded as "... generally denoting the involvement of a significant number of persons in situations or actions which enhance their well-being, e.g. their income, security or self-esteem"(Cohen & Uphoff, 1980, p. 214). Here, participation is not viewed as a single static phenomenon, but as a vehicle for collaborative water resource management under varying conditions and among diverse stakeholders.

The use of participatory methods has changed rural development at the community and institutional levels considerably over the past 30 years. For much of the 1970s, most major donors and governments committed themselves to providing rural social services that would have the direct and immediate effect of reducing poverty (Kleemeier, 2000). Moving away from the strictly contractual form of farmer participation, many governments, NGOs, and private

industries are shifting towards greater project collaboration among all stakeholders. This is particularly important for resource-poor and marginalized farmers to solve some of the most fundamental development problems, including health care and poverty eradication. The actual degree to which participation is employed in development can vary significantly though, depending on how its meaning is interpreted by those employing the methods.

Rural communities have complex social structures, often made up of diverse groups joined geographically but segregated culturally and religiously. Institutions involved in funding and providing the frameworks for participatory development in rural communities can be equally complex, making the formation and development of collaborations a complicated process. Through careful collaboration and consideration of the mutual benefits and goals of the participatory processes, participation is not surprisingly believed to promote local capacity-building and sustainable natural resource management.

2.3.5 Social capital

The concept of social capital has become increasingly popular in development since the early 1990s. Social capital is rooted in the belief that resources are imbedded in social relationships such that people will use their relationships to pursue individual or common goals. In other words, "... relationships matter" (Field, 2003, p. 1). Sociologist James Coleman (1994; 1988) emphasizes the importance of these social networks to marginalized groups and individuals, particularly for the cognitive and social development of young individuals. Political scientist Robert Putnam (2000) describes social networks as having value

to groups and individuals – creating a social interconnectedness directly affecting their productivity. His view looks at social capital as not only relational networks, but at the reciprocity and trust built from them. Perhaps one of the most widely acknowledged definitions describes social capital as "... the sum of resources, actual or virtual, that accrue to an individual or a group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acquaintance and recognition" (Bourdieu & Wacquant, 1992, p. 119). These authors suggest that there is a dark side to social capital when people are oppressed; they argue that privileged social networks are in the hands of the elite and disadvantage the oppressed.

Each of these conceptualizations presents an important way of looking at social networks in the context of development projects. Relationships between individuals or groups are defined by varying degrees of power and trust, hierarchy and cooperative behavior, exclusion and inclusion. Social capital is arguably produced and operationalized by institutions, and studies have long shown that local organizations with strong links to governments and other outside administrative agencies are more effective in development (Uphoff & Esman, 1974). However, while we exist in societies with defined structural mechanisms, our networks are also highly influenced by imbedded norms and behaviors. These social networks and institutional linkages provide groups and individuals with both cognitive and tangible resources that can last significantly longer than the lifespan of a funded project (Uphoff & Wijayaratna, 2000). Access to social capital within and among households has shown to have a positive effect on individual income in rural communities (Narayan & Pritchett, 1999). The inclusion of women in local planning and decision making is therefore a logical step towards improving household security and community development. The careful

consideration of both the structural and behavioral mechanisms with respect to the utility and detriment of social capital provides a useful basis for the analysis of collaboration and gender under the canopy of community-based resource management.

2.3.6 Social learning

Social learning is grounded in the idea that learning occurs in a social context. People learn through observation, self-reflection, and modeling the actions and behaviors of others. Psychologist Albert Bandura is an early proponent of social learning theory. His thoughts on social learning are captured in this excerpt from his influential work *Social Learning Theory*: "Learning would be exceedingly laborious, not to mention hazardous, if people had to rely solely on the effects of their own actions to inform them what to do. Fortunately, most human behavior is learned observationally through modeling: from observing others one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action" (Bandura, 1977, p. 22).

In the context of natural resource management, social learning implies that an interactive, participatory approach among interdependent stakeholders is critical to achieve commonly accepted, positive outcomes. In *Wheel-barrows Full of Frogs*, renowned rural sociologist Neils Roling is quoted as describing social learning as "... the interactive way of getting things done ...based on conflict resolution, negotiated agreement, shared learning, convergence of goals, theories, systems of monitoring, and concerted action" (Leeuwis & Pyburn, 2002,

p. 12). Rather than assuming individuals function solely through an economic view of development, or assuming technology change is the panacea to improved natural resource management, Roling argues that social learning provides a necessary "... convergence of reasons of interdependent stakeholders" (Leeuwis & Pyburn, 2002, p. 12). While the concept of social capital helps sort out the numerous complex networks between stakeholders in resource management, social learning helps identify how these individuals and groups function within these relationships – taking what they learn to change imbedded norms and behaviors or to remain status quo – leading to desirable outcomes in local natural resource management.

2.3.7 Closing remarks on conceptual framework

The performance of these five concepts (collaboration, gender, participation, social capital, and social learning), or the phenomena they create, is anticipated to influence the effectiveness of water resource management and benefit outcomes. Understanding these concepts with regards to the existing mechanisms in local resource management, both the structural and behavioral, helps to understand how externally driven development programs are perceived in rural Mali. These concepts interact to establish the conditions for structural and behavioral mechanisms to influence community-based resource management. Specifically, these interactions reveal how local resources are used and managed in these communities while examining the impacts of the intended project outcome – to improve local water resource management – through a collaborative, gender-sensitive environment.

CHAPTER 3

METHODS

The previous chapter introduced and defined the five concepts that support the research design. These concepts are collaboration, gender, participation, social capital, and social learning. Collaboration and gender are core dimensions of the research – these are the independent variables. The dependent variable, or outcome in this analysis, is improved water resource management. The concepts of participation, social capital, and social learning support the analysis of the structural and behavioral mechanisms in the system as intervening variables. The study areas are described to introduce the local context of this research. The remainder of this section describes the methods used to capture data for these variables based on the questions outlined in the research framework (Table 1.2).

The Sustainable Livelihood Approach (SLA) was used during the selection of data collection tools and subsequent analysis of findings. This approach focuses on the particular actors involved as well as the decision-making processes used to manage livelihood assets such as natural resources, and to promote community development. As a holistic approach, SLA explores issues important to stakeholders, allowing individuals to define their livelihood circumstances (Serrat, 2008). Additionally, it provides a flexible framework[1] created to assist in livelihood analyses which are inherently complex and dynamic (Scoones, 2005). This makes SLA well-suited for exploring water resource management in rural Mali. In this particular analysis, applying the SLA allowed for

[1]The International Fund for Agricultural Development (IFAD) provides a thorough discussion and background materials pertaining to the Sustainable Livelihoods Approach and Framework at www.ifad.org/sla (Accessed June 18, 2011).

a broad initial analysis and more detailed follow-up, to evaluate local resource management influenced by development projects.

Data collection was completed using a combination of tools, making use of both qualitative and quantitative research methods. Using mixed methods in research can provide stronger inferences and the opportunity to explore diverse viewpoints (Teddlie & Tashakkori, 2003). In this particular research, mixed methods permitted reexamination of the conceptual and field research frameworks as the study progressed, and validated the research for a larger audience. From an operational standpoint, the flexibility of the research methods was complementary to the need to be adaptable while conducting research in rural Mali.

3.1 Personal influence on research methods

Personal bias is often recognized as an inherent characteristic of research design, particularly in social research (Hammersley, 2000; Mays & Pope, 1995). Much of this bias is created not only by the social interactions between a researcher and a participant, but also how the research is designed and how the data is interpreted – each of which are influenced by the researcher's background and role in the research project.

For several months prior to designing this research, I worked as a graduate researcher for the Cornell International Institute for Food, Agriculture and Development (CIIFAD) on projects related to the West Africa Water Initiative (WAWI). During this time, I started out by looking at how the partnership functioned at the senior management level, then more closely at how World Vision

staff engaged in WAWI projects in the field. This led me to my graduate work examining water management practices in a more holistic manner, as a system, including the institutional frameworks of government, NGOs, and rural communities, in addition to the behaviors of individual stakeholders. With a background in environmental engineering and water resource management, graduate training in qualitative and qualitative methods, gender analyses, development theory, and environmental governance shaped the design and implementation of the research.

In an effort to minimize the amount of error that could arise between various research participants from personal bias, many of the interview questions were standardized, as was the way the questions were conveyed from one interviewee to another. These measures were important to develop a baseline of responses in which the results provided the best possible conceptualization of local water management as experienced by members of rural communities, NGO staff, and government administrators. It is not realistic, however, to think that any standardization of questioning would eliminate bias completely, especially since individuals interpret questions differently and the social dynamics of an interview situation are rarely replicable. In this research, I felt it was more important to accept an obvious degree of bias in the research and instead, focus on understanding the context of the interview interactions. The use of both qualitative interviews and quantitative surveys across a wide range of participants helped to gain a sense of hidden nuances across the data. Although I made an effort to both minimize and recognize bias throughout the research, the results remain my interpretation of water resource management among communities in the San area living within the Bani River basin.

3.2 Preliminary field work

Relevant background information was collected during a preliminary field visit to Mali in 2006 which helped lead to the research reported in this document. The review included 11 in-depth structured interviews and numerous informal conversations with West Africa Water Initiative (WAWI) partners. Many of the partnerships within the WAWI collaboration in Mali were explored and delineated, including relationships between core partners, local NGOs, and government agencies. The interviews focused on the perceptions of staff within WAWI's lead agency, and helped identify important challenges to the WAWI collaboration at the field level.

3.2.1 Organizational background

As in Ghana and Niger, WAWI in Mali is largely influenced by the activities of the program's lead agency, World Vision (WV).[2] World Vision has been present in Mali since 1975, making it one of the first established international NGOs still active in the country. To conduct intensive, long-term projects in water and agricultural management, World Vision has applied their system of Area Development Programs (ADPs) to concentrate efforts in specific districts.

[2]World Vision is an evangelical relief agency, working in a predominantly Muslim society in Mali. While conducting meetings and trainings with members of households in the study region, it was not uncommon for WV staff to begin sessions with Christian prayer. Although the religious undertones were evident in WV's programming, it was observed that participants accepted these practices as part of the development partnership process. While the role of religion in development, particularly between Christians and Muslims, may influence development partnerships and is worth examination in the field of development studies, the issue was not explored in this research. Based on observations during field work, it was assumed that any objections to various forms of proselytization towards members of rural households were mitigated by the greater potential benefit of community development.

Each of WV's five district Bases are typically made up of three to six ADPs. Each ADP consists of anywhere from ten to more than 100 villages and has one manager to oversee field activities and act as a liaison between WV and each community. Under the manager, there is at least one field agent or development coordinator who may hold the majority of field responsibilities. The ADPs will often have a manager, sponsorship supervisor, development facilitator, and a hygiene/sanitation supervisor.

Because WV had already established itself throughout Bamako, Mopti, and Ségou districts, the initial phase of WAWI activities in Mali were implemented in these same regions. WV refers to this zone as the WV Mali Rural Water Project (MRWP). This geographical organization offers the advantage of utilizing pre-established social, cultural, and political integration in many of the villages familiar with WV activities.

A primary finding from the preliminary analysis was that limited understanding of WAWI and its partnership exists in the field. As a result, the coordination of activities may at times be compromised and local partners may not be fully aware of the human and technical resources available through other WAWI collaborators. This initial finding led to an interest in determining whether the realities or challenges of collaborative development programs affect local participation and project outcomes. The information gained from the visit in 2006 was critical to identify the various development partners in the study region.

3.2.2 Field preparation

Prior to entering the field again in 2008, data were collected and analyzed to provide an introductory understanding of development initiatives and local livelihoods in the study area. The WV field manuals for the Ghana Rural Water Project were reviewed for insight into WV water programs and to understand the local context of the research.[3] During this period, discussions with WAWI staff based in Bamako were conducted to gather baseline information regarding the historical relationships between the agency and local communities. The logistical requirements for field work were also initiated at this time.

The interview tools were reviewed by two individuals familiar with conducting research in rural Mali: a Malian social anthropologist trained in gender studies, as well as a Bamako-based natural resource consultant with a doctorate from Cornell University. Interview questions were field tested to ensure the fluidity of questioning and comprehension by individuals in the communities. Additional background information concerning ADP profiles and water resource availability were obtained from the WV San Base. Prior to entering the villages, annual reports and baseline demographic information for each of the ADPs were carefully reviewed and stored electronically for reference. This information provided an institutional context of local development initiatives in the study area. In 2009, follow-up interviews were conducted with NGO field staff interviewed during the previous year to examine project status and lessons learned as WAWI projects were scheduled to enter a new phase of programming.

[3]Staff at WV Mali indicated these documents were not available in Mali, however, that the information used to train field staff on issues pertaining to water, sanitation and hygiene would be similar.

3.3 Study setting

The remaining sections summarize the geographical and cultural contexts of the study area as they pertain to the relevant government administrative boundaries and WV zones of operation. This introduction sets the stage to examine the institutions and relationships between stakeholders influencing community-based water resource management specific to the three study ADPs. The overview includes environmental conditions, basic demographics, and limited preliminary data regarding community organization and development available from the WV base located in San.

3.3.1 *Région de Ségou*

Ségou is the fourth administrative region in Mali. Situated in the Sudano-Sahelien climatic zone, Ségou is bound by a short rainy season (June to September), hot season (March to May), and cool period (December to early-February). The average annual rainfall is between 500 - 700 mm, which falls almost entirely during the rainy season and supports non-irrigated cereal crops, such as sorghum and millet. As of 2009, the Ségou region had a population of 2,336,255 in 391,116 households (INSTAT, 2009). The population has increased by 40% since the last major national census was completed in 1998. Women currently represent 50.5% of the population in Ségou.

The region is culturally diverse, although the majority of the households are Bambara. The physical households are rectangular-shaped, built with mud and straw, clustered together within a larger compound, housing up 60 family mem-

bers. The family granaries, livestock, and private well[4] are also found within the household compound. Agricultural activities are generally limited to the rainy season, although small private and community gardens can be productive year-round with reasonable access to water and regimented watering schedules. The area is primarily agrarian, providing the nation with a third of its total cereal production (USAID, 2007). Both rice and millet contribute the greatest to regional the cereal production. Additional regional economic activities include livestock production, forestry, and a small textiles industry.

3.3.2 *Cercle de San*

The study was conducted within the *Cercle de San* and WV San Base administrative zone. The small city of San is located 410 km southeast of Bamako, approximately five hours driving time. The San Base is a central zone for field activities for WAWI-WV, as well as a number of other WAWI partners, including Winrock International, United Nations Children's Fund (UNICEF), Cornell International Institute for Food, Agriculture and Development (CIIFAD), and the joint activites between United States Agency for International Development and the consulting firm ARD, Inc. (USAID/ARD). The primary partner conducting water provision projects is WV, which is the focus of this analysis. The WV San Base serves approximately 300 rural communities in the Ségou region of south-central Mali through the provision and maintenance of water supplies, agricultural and financial programs, and hygiene/sanitation education. Water projects in the *Cercle de San* refer to boreholes with hand and foot pumps, large diameter wells, hand dug wells, and rehabilitated wells. These various water

[4]The distinctions made between the various types of water points in this research are provided in Appendix A.

points are defined in Appendix A.

As mentioned, the San district is a key location for WAWI-WV activities. Three ADPs in the Ségou region have been continuously active with WAWI since 2003, including two of the identified research locations: Diéli and Sanké ADPs. The area is representative of the range of projects WAWI has implemented with regards to the partnership's commitment to the provision of safe, sustainable water. The San area is also representative of a number of other WAWI zones of implementation in rural Mali, both culturally and with respect to existing development initiatives.

A total of nine villages in three WV ADPs within the *Cercle de San, Région de Ségou* were asked to participate in the study as shown in Figure 3.1. These nine villages included Ténéni, Daelan-Sobala, Somo, Diakourouna-Nirisso, Niamana-Masoumana, Tiomporosso, Paparoné, Bankouma-Bobo, and Pona (the GPS coordinates for these villages are provided in Appendix B). Due to logistical challenges, one of the villages in Koodugu ADP (village of Pona) did not participate in the entire study, however, six villages consistently involved in WAWI-WV programs, and two villages outside of the program's implementation plans, participated in all stages of data collection. The preliminary data collected for the ninth village was included where appropriate, as it adds value to discussions on community governance and the state of water resources in rural Mali.

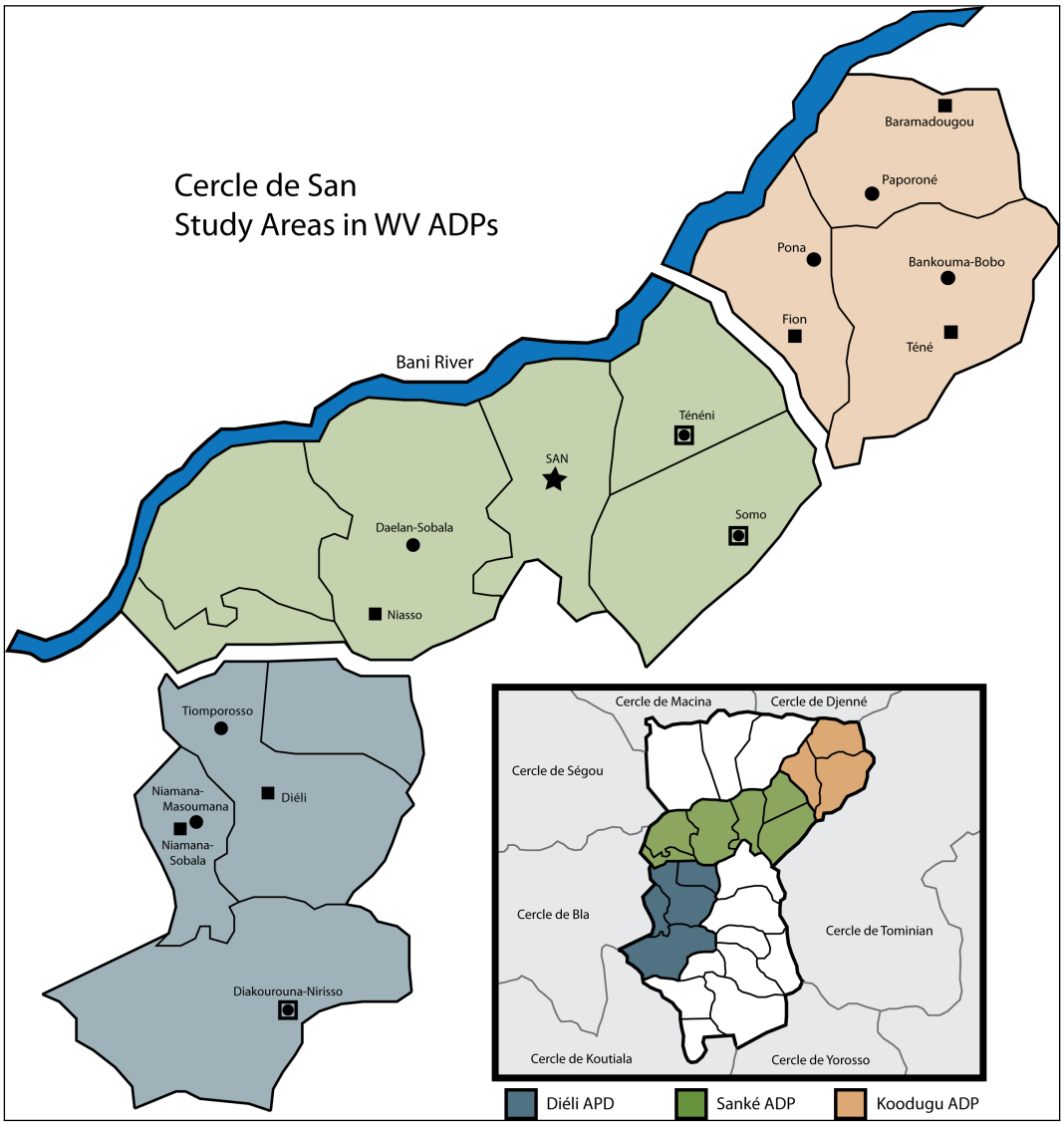


Figure 3.1: Study ADPs showing *commune* boundaries and participating villages

3.3.3 Sanké ADP

The Sanké ADP was established by WV in 1995 working with 67 villages in six *communes* with a population of 105,190 (INSTAT, 2009; WV, 2008c). There are six *communes* located in Sanké: San, Niasso, Somo, Ténéni, Ngoa, and Djeguena. Funding for programs in education, health, food security, and sponsorship has

been provided by WV Germany. The villages of Ténéni, Daelan-Sobala, and Somo were included in this study. Village populations vary from 200 to 1500 inhabitants. Rainfall ranges from 600 - 700 mm annually, falling primarily between the months of June to October. Temperatures rise during the hot, dry season to 40 - 45°C, particularly from March to May. Around half of the soils in the ADP are classified as sandy and the rest as clay-sandy. Vegetation is classified as savanna and grassy-steppe, but firewood collection, bush fires, and clearing land for agriculture have significantly impacted vegetation growth (Niasso, 2006). Intensive agriculture and livestock production in the region have severely diminished pastures causing conflict between farmers and pastoralists. Approximately 94% of the population consists of farmers, while 3% are fishermen. The remaining members of the population are craftspersons and traders. Most village activities come to a halt on Mondays when villagers travel to San, the largest weekly market in the area, to sell their products, purchase food and supplies for their household, and socialize.

The principle ethnic groups in Sanké include Bwa, Bambara, Marka jalan, Minianka, Peulh, and Bozo. Although approximately 70% of the population in these groups speak Bamanankan, Bomu is also common. The majority of the population is Muslim, although about 11% are Animist and 3% are Christian. Local decision-making is generally androcentric as the fathers and husbands in the households often coordinate the economic activities of the family including field work during the cropping season, and participate most frequently in community forums. A survey of the ADP in 2005 found that only 30% of households collected 15 or more liters per day of potable water during both the dry and rainy seasons (WV, 2006b).

During the same WV study (2006b), community participation was also evaluated and described as varying significantly depending on the village. Community participation was judged mostly on an individual's understanding of development and knowledge of local development issues. Community participation in planning, implementation, and management was also considered. Not surprisingly, the study found that most community participation was performed through the village leadership. The consolidation of power by leadership was also identified among many community-based organizations (CBOs) in the ADP. For the most part, the study also described CBOs in Sanké villages as ranging in degrees of transparency and modes of participation. As the ADP has evolved, management has focused on promoting the inclusion of women in local development, particularly by changing the gender dynamics of CBOs.

3.3.4 Diéli ADP

Established in 1996, the Diéli ADP includes 94 villages with a total population of 45,414 in the *communes* of Diakourouna, Diéli, N'torosso, and Niamana (INSTAT, 2009; WV, 2007b). Populations in each village range from 70 to 1700. WV Canada provides funding for Diéli ADP programs including education, health, food security, and sponsorship. The three study villages from Diéli ADP included Diakourouna-Nirisso, Niamana-Masoumana, and Tiomporosso.

The soils are mixed with sand, clay, and gravel, and the relief is relatively flat throughout the ADP. Temperatures often reach 45 °C during the months of March to May. Rains typically occur between June and September with about 600 - 800 mm each year, supporting brush and savannah trees such as baobab,

karité (shea), néré, and balanzana (*Acacia albida*).

World Vision records also note that 99% of households in the ADP practice subsistence agriculture (WV, 2008a, 2007a). Millet, sorghum, and fonio are the staple cereals grown in the region. Meals are supplemented by beans and groundnuts; groundnuts also contribute modestly to household incomes as a primary cash crop. Although some households also manage small herds of cattle and sheep, years of drought have reduced pasture lands and increased conflict between herders and crop producers within the ADP. In addition to subsistence farming, small trade of locally grown cereals is an important economic activity among households. Tuesdays and Thursdays are the main market days in the area, with the largest held in Diéli on Thursdays.

Three main ethnicities are found in the ADP, including Bambara, Minianka, and Peulh. The majority of households speak Bamanankan (83%), with the remainder using Mamara or Fulani. Islam is the primary religion in the area, although some households practice Animism and Christianity.

A survey completed in 2004 identified only 26% of households within Diéli ADP had access to 15 liters or more per person of potable water within 30 minutes of their homes, during both the dry and rainy seasons (WV, 2005). In addition to basic water security, the survey noted the relative degree of community participation in the ADP villages. Not unlike Sanké ADP, decision-making in the communities tended to be the responsibility of men. Members of local committees with positions of leadership, and those playing an integral role in village council work directly with the chief to make decisions on behalf of the community. The report suggested limited participation by others in the planning, management, and evaluation of community development. After the 2004/2005 eval-

uations were completed in Diéli, ADP staff mandated to strengthen community-based organizations in villages.

Having a number of progressive villages engaged in WAWI-WV activities, Diéli was the demonstration site for multi-use water points. At a number of public water points, WV had constructed laundry baths and animal troughs to determine if such infrastructure would be useful for households as part of project planning. As a result of this intervention, these infrastructures are being considered for other WAWI-WV zones.

3.3.5 Koodugu ADP

Koodugu ADP was founded in 2005, covering the *communes* of Téné, Fion, and Baramadougou with a population of 37,315 in 42 communities (INSTAT, 2009; WV, 2008b). Village populations range from 100 to 4000. Funding for all programs including education, health, food security, and sponsorship has been provided by WV Germany and Spain. The villages of Paparoné, Bankouma-Bobo, and Pona were included in this research, although limited data collection was completed in Pona village.

The ADP is a mix of sandy-clay (Téné, Baramadougou) and silty-clay (Fion, Baramadougou), with generally poor nutrient value. Savannah and grassy-steppe cover most of the region. Scattered stands of baobab, néré, and balanzana can be found in the area, although wood supplies for firewood and construction are decreasing rapidly.

Koodugu ADP is home to a diverse range of ethnic groups include Bwa,

Bambara, Fulani, Markas, Bozo, and Dogon. Bamanankan is the most commonly spoken language, although it is not uncommon to find Bomu-speaking households throughout the area. At least 70% of the population is Muslim, followed by Christian and Animist. Subsistence farming is practiced by the majority of households in the region, growing mostly millet, sorghum, and groundnuts. Livestock rearing is common where sufficient grazing land exists, although land degradation is leading to increased conflict between pastoralists and cultivators. As in Sanké ADP, fishing is an important economic activity for the villages located along the Bani River. During the rainy season, the swollen river supports small-scale rice production, primarily for local consumption and small trade. The two major markets in the ADP are Téné and Baramadougou. The largest market, drawing most of the communities from the ADP, is held on Saturdays in Téné.

Since Koodugu ADP was formed in 2005, a preliminary planning period had been in progress to prepare for the first four-year phase of programming scheduled for late-2008. Some of the findings indicated limited access to education among children, unequipped community health centers, and a lack of cereal stocks for lean periods (WV, 2007c). Many communities in the region rely on unprotected water sources and residents have little knowledge of basic hygiene and sanitation. The review also noted that a number of CBOs exist in the communities, although not all function effectively due to lack of transparency among local officials within the communities and government (WV, 2006a).

3.3.6 Closing remarks on study setting

The three ADPs described above are representative of the diverse cultural and geographical conditions among farming households along the Bani River. This basic overview suggests that although farmers in the *Cercle de San* face environmental challenges to crop and animal production, households have access to small, local markets to support modest incomes. The communities in these ADPs have also experienced varying degrees of development assistance, providing a diverse sample of households with unique perspectives and experiences in water-related development efforts. Summary reports from WV, while lacking detail in their analyses, do indicate challenges to participatory processes in development projects. This study examines these challenges in greater depth, from the perspectives of the range of stakeholders in local water management within these ADPs. The specific processes and tools for conducting data collection in the communities are described in the following section.

3.4 Stakeholder interviews and focus group discussions

Representatives from government agencies familiar with WAWI-WV projects, identified during initial field work in 2006 and throughout subsequent data collection in 2008, were asked to participate in individual interviews to examine the public-sector role in local water resource management. Staff from WV in charge of WAWI-WV activities at the national and ADP levels were asked about their roles in local water resource management. These open-ended interviews provided an opportunity to gain background information on current and past programs in the region. The focus of this research, however, was on the

communities themselves. Open-ended interviews and surveys were used to gather detailed qualitative and quantitative household data, while focus group sessions were useful to identify and explore important local issues. Using mixed data collection tools, 360 stakeholders in the development process in rural Mali participated in the study, with a focus on those involved in collaborative water resource management with WAWI-WV projects in the San district.

Table 3.1 identifies the specific stakeholders who were asked to participate in this study including government agencies and WAWI partners. Before commencing the core field work, WV field staff were briefed about the intended research and presented with a timeline for the field work within the study villages. This permitted field staff to introduce the research to the villages during an initial visit with the administrative village chief. The chief was presented with 11 kola nuts as a gesture of respect and asked for the voluntary participation of the village. The *chef de village* and village council were identified to gather information on the interactions between their communities and external development initiatives. Each were asked to participate in a semi-structured interview as a group.[5] The chief and village council were considered key informants for the village, prior to initiating further interviews.

Individual household surveys followed a combined questionnaire and semi-structured interview format. They were completed to gather specific information on household demographics, sources of income, patterns of water use, and detailed questioning on local development and participation. For the purpose

[5]In southern Mali, the *chef de village* traditionally maintains authority over the local population, whereas the *chef de terre* monitors local resource use (as found in the study villages, this is not always a distinct position from the *chef de village*). The village council also plays an important role in communal affairs such as access rights. It should be noted that women and children are often excluded from these forums. A discussion about these relationships is provided by Hilhorst and Coulibaly (1999).

Table 3.1: Stakeholder participation

Government	WAWI-WV	Village
Direction Nationale d'Hydraulique, Direction Nationale d'Agriculture (Bamako)	World Vision Mali Rural Water Project Director (Bamako)	Chief, Village council
Direction Regional de l'Hydraulique et de l'Énergie (Ségou)	World Vision Base Director (San)	Water and sanitation (WATSAN) committee members
Cercle de San Sous-Préfet (San), Commune administration (mayor and council)	World Vision Area Development Program (ADP) managers and field staff (San, satellite bases)	Water users not associated with council or WATSAN committee (an equal number of men and women from the village)

of this research, adults were considered anyone 15 years of age or older.[6]

As an important component of WAWI-WV water projects, members of village WATSAN committees were asked to participate in semi-structured interviews to explore the role of community organization in village water resource management. Members were asked to share their experiences with water resource management projects in the community based on the WV ADP model of community participation.

The interviews conducted within the community set the stage for focus group discussions. Following the individual household surveys, focus group sessions with randomly selected individual water users (not on the WATSAN

[6]The *Malian Code du Mariage et de la Tutelle* of 1962 (Chapter 111, Article 4) states the legal age for marriage is 15 for women and 18 for men (UNHRC, 2003). Although this code was up for review by the government during 2010, it met significant resistance by the Islamic community and at the time of this publication, the law had not yet been revised to raise the legal age for marriage for women to 18. The reality is that in rural areas, marriage and childbearing can begin even earlier than 15 years for young women. Local Islamic culture permits women under the age of 15 to enter union. The Center for Reproductive Law and Policy reports 22% of women in Mali are married before the age of 15. Almost 10% of women have began bearing children by 15 years of age, with 46% giving birth by their 17^{th} birthday (CRLP, 1999).

committee or village government) were conducted to identify themes and clarify key issues important to the community concerning water management. Initial interviews build rapport with individuals and establish important background information (Johnson & Turner, 2003), while focus group sessions allow in-depth discussions with groups of participants. The order of interviewing was found to facilitate data collection, most noticeably by individuals' willingness to participate and their level of engagement in discussions.

Between five and fifteen individuals were asked to participate in each of the focus group sessions. A gendered approach was used by organizing different sessions for the men and the women. The process was useful to reduce power imbalances between genders, while also realizing that these groups are not homogenous amongst themselves. These sessions addressed ambiguities, conflicting issues, and further questions identified through semi-structured interviews. The advantages of using focus groups at this stage of the research were 1) to probe for more information in a short period of time, and 2) to examine how community members react together when discussing issues of participation and external development intervention. During the focus group sessions, activity calendars and resource mapping (Buenavista & Flora, 1994; Feldstein & Poats, 1994; Grandin, 1994), as well as conceptual diagrams (Lightfoot et al., 1994) were completed to clarify gendered resource use and resource availability around the village.

The final set of questioning focused on government institutions and policies related to water resource management. Government representatives responsible for water programming in the region were asked to participate in semi-structured interviews. This stage of interviewing examined the govern-

ment perspective of local water management at the national, regional, and local levels.

All interviews and group sessions were conducted wherever convenient for participants. Interviews were designed to last approximately one hour for each session. The men and women involved in household interviews and surveys were asked to commit to two sessions. It is important to note that during the interviews and group sessions, questioning was flexible and adapted during the discussions to probe for the necessary information in a manner appropriate for the participants. The semi-structured interviews, focus group session agenda, and household surveys are provided in Appendix C.

3.5 Timing of data collection

The interviews, surveys, and focus groups sessions were conducted in three waves in each village (only the initial wave was completed in the village of Pona). After talking about field research in rural Mali with a number of individuals familiar with the region, it was deemed most practical to enter the villages in short, sequential sessions to ensure participant enthusiasm was maintained throughout data collection (Figure 3.2). The first wave focused on gathering data from initial key informants within the community (chief and council), as well as initial qualitative household survey data. The second wave included interviews with water and sanitation (WATSAN) committee members and focus group sessions. The third wave was then completed to collect the remaining household survey data. With the approaching rainy season, this strategy put less pressure on individuals in the community to participate all at one time.

After these waves were complete, further interviews were conducted with individuals outside of the village, such as WV field staff and government representatives, who were not as constrained by the rainy season. Follow-up interviews were conducted one year after the core waves of data collection to give NGO staff an opportunity to reflect on field activities in the study villages as Phase II of WAWI was about to be implemented.

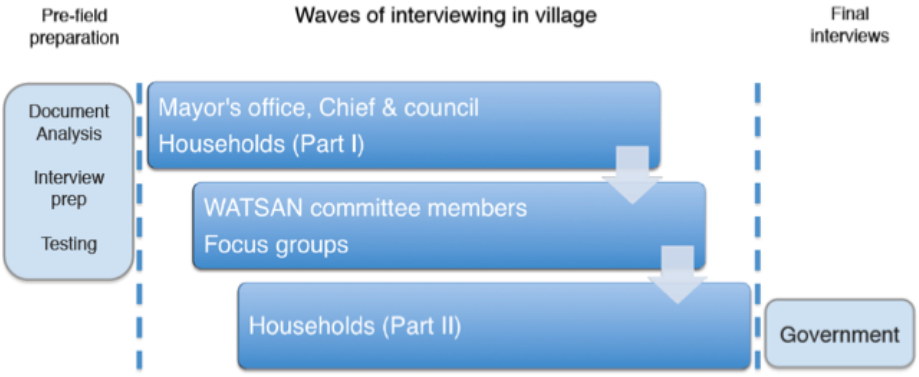


Figure 3.2: Field work design

3.6 Sample selection

Random sampling is often considered the preferred method for site selection (Holland & Campbell, 2005); however, this was not possible due to the logistical challenges of conducting research in rural Mali and the need for a targeted sample population. Purposive or criterion sampling (Kemper et al., 2003; Lewis & Ritchie, 2003; Patton, 1990) allowed the experiences, behaviors, and contexts of a predefined portion of the population to be explored in this research. For those reasons, purposive sampling was most often used throughout this study. Table 3.2 outlines the factors supporting the use of purposive sampling in relation to

the core components of the research, which defined site selection.

Table 3.2: Factors supporting purposive sampling

Supporting Factor	Related Components
To focus on a particular portion of the population for comparison	Linkage to WAWI-WV
	Establishment of water committees
	Presence of gender mainstreaming initiatives
	Traditional systems of decision-making
	Policy supporting community participation
To identify and focus on specific issues pertaining to the sample population	Perceptions of outsiders (WAWI partnership)
	Perceptions of WAWI-WV development projects
	Unintended consequences of intervention design
	Roles of women in community-based natural resource management (CBNRM)

The benefits of choosing purposive research sites with the help of WV staff outweighed the numerous unknowns of selecting random study locations, especially given the specific site requirements and length of study. A previous study by Gleitsmann (2005) indicated the successful use of WV staff in the site selection process.

Because the research locations were chosen purposively, bias was constructed in the analysis. The nature and location of this bias is recognized and has been taken into consideration with the selection of methodological tools for the research.

Purposive sampling was also the primary method used to identify specific individuals or subsets of the population during the analysis. For example, through purposive snowball sampling (Patton, 1990), individuals from local water and sanitation committees using gender mainstreaming initiatives were

asked to participate to examine the role of men and women in local resource management. These participants were identified through interviews with local NGO staff and village council, who are typically responsible for establishing systems of local governance. This subset of the community could not be identified through random sampling techniques because only a specific portion of the population holds a position on such a committee.

Participants for individual household surveys and focus groups, however, were selected randomly with the exception of Ténéni and Tiomporosso villages. In these two villages, households were selected by the chief. The selection was provided after insisting that the sample population must be representative of the diverse range of households (varying degrees of capital and access to water resources). After the interviews and data analysis were completed it was evident that the village chiefs did, in fact, provide this diversity. Village chiefs did not select individuals who had greater relative household wealth or particularly skewed (overly favoring) perspectives on village governance, as evident by the demographic data collected among households in these villages (see Chapter 6).

In preparation for field work, the potential research locations had to be chosen among a selection of rural communities within two of WV's ADPs – each being representative of the range of communities found throughout WAWI-WV with relative cultural, economic, and environmental diversity. These sites were delineated by choosing villages actively involved with WAWI-WV since the start of the collaboration's programs in Mali. There were two additional requirements for site selection to more accurately define their involvement with the WAWI-WV program: first, the community had to be located where local WAWI-WV partners had established an improved water supply (specifically

boreholes, modern wells, or rehabilitated sources), and secondly, the communities had to have been participating in WAWI-WV water and sanitation committees, referred to as WATSAN committees.

In 2006, WV completed a grading of villages within the MRWP. Based on six parameters (local participation, community organization, use of facilities such as latrines and pumps provided by WV projects, financial accountability/organization, accessibility, and presence of signage), each village was assessed and categorized as progressive, promising, or challenging. Using this grading, study villages were narrowed down in the two ADPs, identifying a sub-group of potential sample villages falling under progressive, promising, and challenging. The grading system provided a way to categorize the study villages in a manner consistent with field data concerning water resources, as well as with respect to social indicators already available through WAWI partner. With the assistance of the WV ADP managers, the list was further narrowed down to one village falling in each category, based on the status of each village as of 2008. Although this selection process had the potential to be biased using the judgment NGO staff, field work confirmed that a broad spectrum of villages had been selected to observe the range in village resources, participation, and perceptions of development initiatives.

The third ADP and subsequent group of villages included in this study were selected with the assistance of the ADP manager. The villages lacked WAWI-WV interventions, yet were located within the project zones. These villages displayed the extremes in community development from nearly zero outside intervention to various partnerships with NGOs and government. This aided to identify preconceived notions of development programs, which may otherwise

be attributed to imbedded norms and behaviors. Although these communities would have the same exposure to radio broadcasts and various types of sensitization efforts to improve hygiene or to raise HIV/AIDS awareness, boreholes and pumps would not have been installed in these locations by WAWI-WV. Ultimately, these local populations had significantly less contact with WV and other development agencies than the villages in the two other study ADPs. WAWI-WV activities were scheduled to commence in the ADP during the later months of 2008, therefore at the time, this analysis provided a unique opportunity to evaluate villages that had not been directly exposed to the WAWI collaboration, and minimally to other externally-funded development initiatives.

3.7 Field assistance

A multilingual interpreter was contracted in San to assist with field work. Interviews were interpreted from the native language of the participant to English and French. The interpreter was thoroughly briefed on the research and trained prior to field visits. The interpreter assisted with interviews and focus group sessions in the villages, as well as with external stakeholders including representatives of national and local government. Because the interpreter was not hired from within the villages themselves (not realistic given the research timeframe and village demographics), this research study may rightly be perceived as an outside endeavor, possibly intrusive to some participants. For that reason, the interpreter was instructed to respect this possibility and to observe the mannerisms of participants, identifying any body language that might further explain responses. All interviews were given verbally, because of the high illiteracy rate in rural Mali – one of the highest in all of Africa. Thorough notes

were recorded on prepared interview forms by both the author and interpreter.

3.8 Closing comments on methods

Interviews, focus group sessions, and household surveys were used to triangulate the various issues that communities experience through international development projects. An historical context of water resource management in the communities identified 1) many of the positive and negative elements of development projects aimed at improving natural resource management, 2) how collaborative projects may impact patterns of resource use, and 3) how the attempts by development agencies to include men and women differently in local resource management is actually realized by communities in rural Mali. The results from the discussion groups and open-ended interviews were examined using contextual analysis. The quantitative components of the household surveys were evaluated using a variety of statistical analyses to summarize demographic data and highlight different patterns in resource use and household sustainability. Qualitative data identified key issues with local development projects as well as supported the findings and patterns identified during the more quantitative survey approaches.

CHAPTER 4

RESULTS AND DISCUSSION: COLLABORATIVE PARTNERS IN DECENTRALIZED WATER RESOURCE MANAGEMENT

Boloden ngoni kelen te se ka bèlè ta
we do not pick up a pebble with one finger

– Bambara proverb

4.1 Introduction

Rural development in Mali has become an industry. The Organisation for Economic Co-operation and Development (OECD) reports that in 2008, Mali received over 531 million USD of official development assistance from donor governments and multilateral funding.[1] This amount is 73% of what Ghana received, and nearly double the official aid to Niger during the same year. The names of hundreds of NGOs and government development programs can be seen on hand-painted signage of office fronts in every major town throughout the Sahel. Conspicuous white land cruisers speckle the few paved highways stretching across the country – a common scene in Mali since the nation garnered unprecedented attention from devastating droughts through the 1970s and 1980s. While the outward efforts of aid agencies and foreign governments in the region are apparent, it is a superficial glimpse into development in rural Mali. The thousands of projects being implemented throughout the country vary in scope as widely as they vary in success. Part of this variability can be

[1]Data available from the OECD searchable database at http://stats.oecd.org (Accessed December 8, 2010).

attributed to the nature of relationships in these projects between government, local NGOs, and rural communities.

This chapter explores some of these relationships in the context of WAWI program areas within the *Cercle de San*. Data are based on interviews with representatives from various levels of government (national, regional, district, and communal), NGO staff, and village leadership (chiefs and councils). The analysis begins by establishing the historical political circumstances leading to the current Democratic Republic of Mali. The context of governance in Mali since colonialism is examined in more detail, exploring the role of decentralization and the frameworks in place to support local resource management. This is followed by an examination of NGO approaches, focusing on how WV works with rural communities on behalf of WAWI. Other local NGOs involved in water projects are also discussed, but in less detail. Finally, the mechanisms of community organization are explored to glean a better understanding of the diverse stakeholders in community-based resource management and their perceived roles.

4.2 Political context of Mali

Mali has an extraordinary history in West Africa filled with tales of expanding chiefdoms, kingdoms, and empires. The Mali Empire had thrived along the Niger River Valley, the famed trans-Saharan trade route through the 14^{th} Century, until displaced by neighboring powers and invaders. Communities followed the rule of chiefdom leadership through strict systems of patriarchy and valued family lineage. The embattled empires met their final fate when

new sea routes redefined regional trade in Africa.

Islam had spread throughout the region by the 14^{th} century, becoming the predominant religion, although traditional animist beliefs remain an important part of local culture. To this day, animist practices are interspersed within many Muslim and Christian households in rural Mali.

By the late 19^{th} century, Mali fell under French colonial rule, which remained in place for 70 years. During this time, France installed strict control over the country, creating a centralized government and dividing the region into administrative units called *cercles*, each headed by a French commandant. Natural resources were controlled to provide expatriate officers and their home country with commercial benefit, extracting products like gum arabic for the textile industry and other raw materials to support Europe's industrial revolution.

For much of France's rule over Mali and other African colonies, efforts were made to assimilate locals by implementing a French education system. The idea was to create an environment for French culture to be absorbed by Malians, only later adjusting this approach to one where Malians would learn to simply relate to French history and culture through association (Collins & Burns, 2007). This was an early attempt at development, to transition the uneducated and undeveloped (in the eyes of Western elites) into a civilized European society. As a growing discontent towards colonial powers was spreading throughout Africa, Mali finally declared independence from France in 1960.

Political division in the newly formed state challenged the first elections. The newly elected leader, President Modibo Keita, quickly turned Mali into a single-party state modeling the system of the communist nations of the East.

The socialist policies were aimed at the nationalization of the region's resources. Keita's efforts to convert the currency to the Malian Franc stagnated the nation's economy. Trans-border trade came to a halt, causing food shortages and social angst. A military coup led by a young lieutenant in 1968 replaced Keita with a military government, commanded by General Moussa Traoré. This new leadership focused on restoring the economy and building a platform for a future civilian-led government.

During this time, Mali was struck by a long period of drought between 1970 and 1974 causing thousands to succumb to famine. With pressure from the WB and the IMF during the mid-1980s, the Malian Franc was abandoned in favor of the West African Monetary Union. Even with these economic reforms, Mali was affected by another harsh drought from 1983 through 1984. Rampant government corruption further stalled economic recovery. During 1990, the pro-democracy movement and student unrest in Bamako had peaked, exacerbated by instability created by the Tuareg revolt in the north. This led to a bloody protest in Bamako in March 1991, immediately followed by a *coup d'état* led by Lieutenant Colonel Amadou Toumani Touré, which successfully overthrew the Traoré government.

Mali's first free, multi-party elections were held in 1992, with a former teacher, Alpha Oumar Konaré, gaining the presidency. A new constitution helped guide the new president to reduce corruption, improve the national economy, and gain the confidence of Malians. Although not completely immune to controversies and problems, Konaré was elected for two full terms and was viewed favorably by the international community. He was succeeded by Amadou Toumani Touré during the 2002 presidential elections, the Lieutenant

Colonel who had brought democratic governance to the country a decade earlier. Touré, affectionately known as 'ATT' in Mali, moved quickly to expand the funding from multilateral agencies initiated in the 1980s, and adopt their structural adjustment programs. These economic policy reforms were designed to create a more liberal economy in Mali to accelerate the nation's development. Such reforms have had mixed support by international scholars (Collier & Dollar, 2004; Easterly, 2001; Riddell, 1992), but focus consistently falls on specific economic policy and maintaining stability and transparency of the recipient governments. While these discussions serve an important analysis of national governance, the local contexts of these programs are often lost. Exploring and understanding the impacts of vast decentralization efforts on livelihoods and the environment brought about by these programs have great validity for the largely agrarian-based Malian population (Koenig & Diarra, 1998).

4.3 Historical water resource management

Water resource management in the San area (Figure 4.1) began with the arrival of nomadic traders during the early empires along the Niger and Bani Rivers and their tributaries. Traditional hand-dug wells were made as settlements were established. As the populations grew and water demands increased, households began digging more wells throughout their villages. Traditional knowledge eventually passed across generations, and households started to dig private wells within family compounds to provide for an expanding number of family members. Without outside intervention, communities relied on rivers, streams, seasonal ponds, and hand-dug wells for all their water needs. With the exception of the *Office du Niger* and the water service created by the

French colonial administration, *l'Afrique Occidentale Française* (AOF)[2], very little was done in terms of water management in the region during colonialism, at least not at the village level.

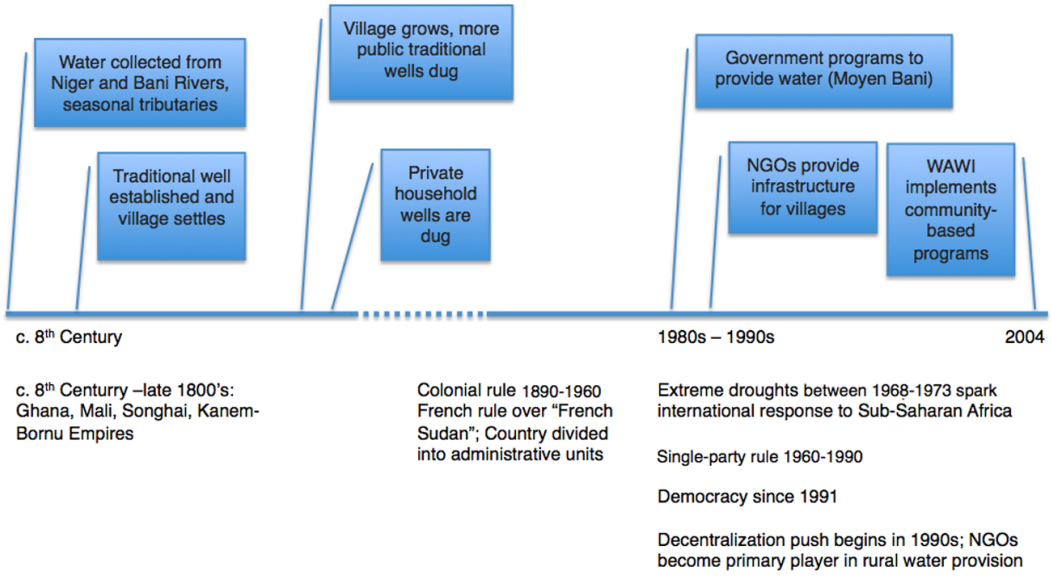


Figure 4.1: Historical resource management in south-central Mali

One of the most devastating environmental disasters on record in the region occurred during the 1970s. Extreme drought conditions over sustained periods left growing communities without water throughout the country. The human and animal loss were so devastating, it garnered the attention of the international community. Funding from international donors was provided to help the

[2]The AOF water service, established in 1929, worked specifically to map and study systems of ground and surface water throughout the country, rather than shape local policy (Mali, 2000). The *Office du Niger* was a large irrigation project designed to make Mali the rice and cotton production center of Africa. It is largely perceived to have failed due to poor design and implementation (Filipovich, 2001). There are currently efforts by the Malian government, foreign aid agencies, and private investors to revitalize the *Office du Niger* to rehabilitate water control systems and expand agricultural production along the Niger River basin. These current efforts suggest downstream communities within the basin will lose land and significant water supplies (the Libyan government has already secured 100,000 ha for their own food production), impacting farming and fishing villages along the 425 km river delta. The eviction of farming households by the *Office du Niger* has resulted in an illegal land market and a downward shift in small-scale farming activity to the detriment of subsistence households along the Niger (Coulibaly & Belieres, 2006).

cash-strapped nation conduct a national-scale water project. As more international NGOs established offices to support humanitarian aid, the implementation of water and other development projects increased, providing basic infrastructure to rural communities. Now, these international NGOs and a growing number of local NGOs have intersected under government decentralization efforts to provide the backbone of rural water projects in Mali. The West Africa Water Initiative (WAWI) is one example of this evolution in Malian rural development.

4.4 Reconstructing local resource management through decentralization

Malian society continues to have a strong connection to French colonial history through its civil structures and laws, geographical boundaries, and an abundance of cultural reminders. However, Malians have held on strongly to their cultural identities, languages, and traditional systems of governance. Today, Mali is home to diverse ethnic groups, each with rich cultural identities. There are over 23 ethnic groups and 57 individual listed languages in Mali (Lewis, 2010). These layers of diversity enrich Mali's culture, but also have led to decades of challenges for those administering public policy – the process of decentralization has been no exception.

The 1992 constitution set the stage for decentralization in Mali. The country was divided into 703 municipalities (*communes*), 49 districts (*cercles*), eight regions (*régions*), and one capital district (Bamako). On August 10, 1999, the *Cercle de San* was established by Law N^o 99-038 pertaining to the act to create

the local authorities (*cerlces* and *régions*). The *cercles* consist of a council elected for five-year terms, maintaining each of their districts' financial autonomy. The *cercles* are responsible for local-level budgets, taxes, heritage, tourism, production, agriculture, and natural resource management. The *communes* consist of the elected *commune* council (*conseil commune*) and the executive (*bureau communal*), which includes the mayor and his or her adjuncts. The executives are elected by the *communes* council to carry out the directives voted by the council pertaining to literacy, health care, local infrastructure, and the environment. Like in the *cercles*, terms run five years. Unlike the French system of communal government, there is an additional level of governance recognized in rural Mali consisting of the village chiefs and councils.[3] These village leaders represent traditional rural governance and are typically in power through patrilineal leadership. Because the authority realized by village chiefs and councils is legitimized by traditional village norms, the political prowess of mayors and their administrations is limited when it comes to local affairs. While elected communal leadership has a number of important functions, which is described in more detail below, mayors function most effectively as mediators between conflicting villages.

Throughout the 1990s, Mali's political and legal frameworks evolved, transferring responsibilities of various public sectors to local governments. By 1995, the Government of Mali had devolved power for much of the nation's natural resource management, most notably in the water sector. The evolution of public policy during that decade set the stage for Mali's decentralization efforts, which have been implemented as a condition for multilateral aid in an attempt to stimulate growth in one of the world's least developed countries. A selection

[3]In urban centers, this level of governance is represented by *quartier* leaders.

of legal codes and references is provided in Table 4.1 to highlight the devolution of power from the state to the regional and local levels, particularly with respect to water resource management.

Table 4.1: Key legal references influencing current local water resource management

Reference	Source	Description
Ord. N^o 90-64	*Direction Nationale de l'Hydraulique et de l'Énergie* (DNHE)	Creation of the DNHE (replacing the previous national water services in place between 1959-1989).
Decree 90-458	DNHE	DNHE charged with responsibility to study and control the systems for providing potable water and sanitation.
Ord. N^o 99-014/ Law N^o 99-023	DNHE	Creation of the *Direction Nationale de l'Hydraulique* (DNH, operating under the *Ministére des Mines, de l'Hydraulique et de l'Énergie*).
Law N^o 95-034 Article 83	*Code des Collectivités Territoriales*	Provides local elected civil authorities responsibility to design, implement, and lead development programs in the *communes* and *cercles*.
Law N^o 95-034 Article 72	*Code des Collectivités Territoriales*	Requires the involvement of village councils and community organizations in the development of their municipality.
Law N^o 96-050	*Code des Collectivités Territoriales*	Defines constitution and management of local authorities.
Ord. N^o 00-021	*Programme d'Alimentation en Eau Potable et d'Assainissement en Milieu Rural et Semi-Urbain* (AEPA)	Ordinance for the organization of the public service sector to provide potable water throughout the country; Sets the legal framework for public water management to be delegated to local authorities at the *commune* level.
Article 3267	Legal framework for the AEPA National Strategy	The National Strategy outlines the specification for project cycles, roles of the commune and relevant stakeholders, and the cost-sharing responsibilities between these actors.
Law N^o 02-006	*Direction Nationale de l'Hydraulique* (DNH)	Defines rules of use, conservation and protection including the roles of local authorities.
Decree 02-315	DNH	The details of the powers transferred to communes and *cercles*, as well as the provision of technical support by the State.
Decree 02-369	DNH (as represented by *Direction Régional de l'Hydraulique et de l'Énergie* or DRHE)	Regional and sub-regional water departments (DRHE) are established to clarify the role of decentralization services in the public water sector, with these departments responsible for technical support and advising to the local authorities.

In order to support decentralization, a number of institutional mechanisms have been implemented to guide natural resource management policy. Two such mechanisms include: *Programme d'Appui aux Collectivités Territoriales* (Program to Support Local Governments) and *Programme de Développement*

Économique, Social et Culturel (Economic, Social, and Cultural Development Program).

With the financial and technical support of the international community, most substantially from the European Union, the Malian government devised a program to support regional and local levels of government. The *Programme d'Appui aux Collectivités Territoriales* (PACT), implemented within the *cercles* works with 102 local authorities along the Niger River including the *communes* of the *Cercle de San*. The program is designed to assist *communes* with the decentralization process by 1) providing financial investment for local communities, 2) strengthening and legitimizing local administrations, and 3) providing negotiation and conflict resolution for local and regional stakeholders.[4]

PACT plays an important role in the restructuring of natural resource management as a component of national decentralization efforts. During colonialism, resource management was transferred from traditional systems of leadership in rural villages to the government. Traditional mechanisms such as the Fulani Dina system of law, which managed land, water, and fisheries for countless pastoralist communities along the Inner Niger Delta, were completely disregarded (Cotula, 2008).[5] Rural communities lost a great deal of control over their natural environment, leading to years of exploitation by colonial administrations. Since 2002, the government has been working towards transferring control of resource management from the national to the local governments. It

[4]Further information regarding PACT's objectives and activities is available at http://www.pact-mali.org (Accessed July 4, 2011).

[5]Established in the 19^{th} century, the system of Dina law gave Fulani chiefs the authority to regulate access and movement of livestock and the use of land and water resources across the Delta based on kinship, age, social status, and the payments of tariffs. By taking control of what was deemed "vacant lands," the colonial administration set new rules for use. This undermined traditional local authority, and encouraged the payment of enticements and kickbacks between colonial administrators and local leaders.

is with this devolution of power that the *communes* and communities have regained a semblance of formal control of this aspect of their local development. The decentralization process has proved to be challenging, particularly at the *commune* level. In response, PACT has developed a detailed set of guidelines to assist the various local authorities or *collectivités territoriales* to understand their roles and responsibilities in natural resource management. The PACT guideline for water management (*Guide juridique: La ressource naturelle [Eau]*) identifies the following:

- legal reference and jurisdictions of local authorities,
- regulation of water resources, and
- the partners of local authorities (PACT, 2007).

These series of guidelines were developed to close the knowledge gap among local administrators as specific aspects of devolution in resource management have evolved under decentralization.

Around the same time PACT came into play, additional mechanisms were established to support local development. The *Programme de Développement Économique Social et Culturel* (PDESC), for instance, was created under the auspices of the *Ministère de l'Administration Territoriale et des Collectivités Locales* as a key component of decentralization in rural Mali. In 1995, the *Code des Collectivités Territoriales* gave the 703 *communes* in Mali responsibility for designing and overseeing the implementation of the communal PDESC (Article 83, Law N^o 95-034). The law further required village councils and *quartiers* to participate in this process, with regards to development activities within their village lands (Article 72).

An evaluation of the PDESC development planning process in 2001 revealed a number of constraints for successful implementation. First, the planned investments chosen to meet the needs of villages in the *communes* were unrealistic given the limited available technical and financial resources of local authorities. Second, the process of planning was found to be inefficient. Communal administrators did not have the training needed to perform the assessments, nor the budgets to prepare the documents. The final realization was that the process seriously lacked consistency between the PDESC and the various government stakeholders (MATCL, 2005). The PDESC has since evolved into a detailed five-year planning document to develop and manage targeted development initiatives in villages. The *Programme Direction Nationale des Collectivités Territoriales/Cellule de Coordination Nationale* (DNCT/CCN) defines the PDESC as "... a tool identifying all efforts (physical, material, moral, economic, social, intellectual, and financial) that contribute to the prosperity of a community and the welfare of its people through their own initiatives and actions" (DNCT/CCN, 2003). The preparation of the PDESC now involves considerable participation of local NGOs who commit to projects in the district. In the *Cercle de San*, WV is one of the core partners engaged in the PDESC process.

In addition to PACT and PDESC, there is a multitude of other programs implemented by the government to support specific development projects throughout the country. The Moyen Bani Plains Development Programme is one of these initiatives encountered in *communes* and villages throughout the study area that specifically influence local water infrastructure. The program was formed to construct dams along the Bani to control the river's discharge onto the plains. The dams are designed to increase irrigated farmland while also controlling the intensity of floods along the river. The annual floods along

the Bani each rainy season are essential for local rice production. The *Moyen Bani* program was largely financed by the African Development Fund with assistance from OPEC, NGOs, and the Malian government (specifically, the *Direction Nationale de l'Agriculture* or DNA). Construction of the Talo Dam was completed in 2006 and approval for funding to construct the Djenné Dam was finalized in 2009. The environmental impact assessment (ADF, 1997) and subsequent construction of the Talo Dam have created a great deal of controversy in south-central Mali. The greatest concern has been the lack of consultation with downstream farmers and pastoralists directly impacted by the two dam projects (Fisher et al., 2001). There is a great deal of uncertainty regarding actual river discharge and recharge for agriculture production. The longer-term impacts of intensified agricultural production are also unknown. Project proposals include ambiguous mention of agricultural extension, land management, and rural development initiatives planned to coincide with dam construction in the impacted villages. It is unclear how these efforts will be employed at both the communal and village levels.

The *Moyen Bani* project was frequently mentioned when questioning the origin of older foot pumps at a number of the rural schools in the study area. As the planning and assessment stages were completed for the dam projects along the Bani during the 1980s and 1990s, the *Moyen Bani* agricultural improvement project was implemented. A core outcome of *Moyen Bani* was the installation of boreholes and pumps in rural villages throughout the Bani River basin. Lacking follow-up, maintenance, and community training to manage the water points, many of the pumps installed through the *Moyen Bani* program are known to be nonfunctional (Fisher et al., 2001). The neglected infrastructure appears to have left most villages with a sense of abandonment by their government.

As new decentralization efforts evolve in Mali, new government initiatives have been replacing the programs of the past two decades. The *Programme d'Appui aux Collectivités Territoriales pour l'Eau Potable et l'Assainissement* (Program to Support Local Governments with Potable Water and Sanitation, or PACTEA) was created to focus on the provision of modern water points (pumps, modern wells, solar pumps, water towers) over a four-year project period in the regions of Ségou, Mopti, and Kayes. Evidence of early discussions between villages in the study area and PACTEA were identified in *commune* capitals of Ténéni and Téné, where local leaders acknowledged the anticipated construction of water towers in each village. Regional and communal government administrators were hopeful such programs would modernize public water facilities in larger communities where water provision was strained by poor infrastructure and growing populations.

4.5 Specific roles and responsibilities at local levels

Looking at the structural mechanisms of the different stakeholders and partnerships involved in water management in the San area, a number of general roles and responsibilities have been identified (Table 4.2). One type of stakeholder that has been excluded from this study is the private and publicly-funded operators. These include the agencies and businesses that provide technical services for the operation and maintenance of facilities, in addition to providing financial systems, support, and monitoring. While they play an important role, particularly in the delivery systems of water resources, their presence at the village level is usually *vis á vis* government agencies and NGO partners. Because they do not typically act as independent stakeholders in the decision-

making processes, they have not been examined in this study.

Table 4.2: Roles and responsibilities of stakeholders in water management

Government	Villages	NGOs
National policy development and administration	take on ownership of resources and infrastructure	involved with each level of government and communities
supervisory and support to local authorities	support via defined local/traditional organizations	assist *commune* and sub-regional governments with development plans (PDESC)
assists in financing and providing management support for major projects	contribute to NGO and government projects through labor and/or financial contributions	work closely with village chief and council to design and implement projects
Regional intermediary between regional/sub-regional and the national office		provide substantial capital for village projects
policy and technical support to NGOs		
training of sub-prefect and communal representatives		
Communal local representation of policy		
project management		
facilitating relationships between NGOs and villages		
development of PDESC		
technical support and training		

4.6 Collaboration in the *Cercle de San*

Table 4.3 identifies the specific local partners, both NGOs and government, who have assisted the nine study villages and their respective *communes* in developing water resources, according to local communal and village government representatives. Specific knowledge of different partners and programs was most easily obtained from the mayor and council, given their direct involvement seeking formal partnerships and identifying programs for individual vil-

lages for each PDESC. If a project was conducted prior to 2001, the *communes* acknowledged they had limited formal records of specific projects and development programs. Administrative knowledge of the area, however, identified some of the earlier partners prior to the formation of the local communal PDESC reports. Since the study was not intended to be a thorough inventory of projects, but rather an exploration of water management from the perspective of local communities, proof of projects not completed by WAWI-WV was not sought.

Table 4.3: Local partners in water development identified by communal and village government

Commune	Village	Formal partners/programs
Ténéni	Ténéni	Mali Aqua Viva*, *Direction Nationale de l'Hydraulique** (DNH), *Programme d'Appui aux Collectivités Territoriales pour l'Eau Potable et l'Assainissement* (PACTEA), World Vision* (WV)
Niasso	Daelan-Sobala	WV*, *Programme Bureau de Recherche d'Exploitation des Eaux Souterraines et de Surface* (BREESS), *Compagnie Malienne pour le Développement des Textiles* (CMDT), *Moyen Bani/Direction Nationale de l'Agriculture** (DNA), Peace Corps, *Direction Nationale de l'Hydraulique* (DNH)
Somo	Somo	Mali Aqua Viva*, *Programme de Diversification des Revenus en zone non-cotonniére du Mali Sud** (PDR-MS), *Centre Rural de Développement de Milot** (CRUDEM), WV*, *Programme des Nations Unies pour le Développement** (PNUD), *Centre de Santé Communautaire** (CSCOM), Mission Catholique*, community organizations*, individuals*
Diakourouna	Diakourouna-Nirisso	Mali Aqua Viva, WV*, Government (unknown agency)*
Niamana	Niamana-Masoumana	WV*, Service Santé/CSCOM*, DNH*
Diéli	Tiomporosso	Mali Aqua Viva*, WV*, CSCOM*, Government (unknown agency)*
Baramadougou	Paparoné	Mali Aqua Viva, DNH, Eau Vive, *Groupe Action pour le Développement* (GRAD)
Téné	Bankouma-Bobo	BREESS*, Mali Aqua Viva, DNH, WV, PACTEA, CMDT*, *Promotion de la Femme et de l'Enfant au Mali** (APROFEM), PDR-MS*, DNA*
Fion	Pona	PDR, DNH, BREESS*, Mali Aqua Viva, Government (unknown agency)*

*Denotes past or present partner in water projects within study village

In Mali, the *Direction Nationale de l'Hydraulique* (DNH) is the administrative interface between WAWI and the national government with regards to the provision and management of water resources. During the latter part of WAWI Phase I, DNH maintained a presence on the WAWI National Steering Committee (NSC). Since Phase I of WAWI was about to come to a close at the time of the research to reevaluate the structure of the partnership, the future existence

of the steering committee in Mali is uncertain. The presence of DNH during meetings up to that point, particularly during 2008, showed a commitment by WAWI partners to be inclusive of the range of stakeholders in its regional efforts. It also showed the government's desire to engage with the nongovernmental sector, which had been filling the void in public service provision that grew as the nation expanded decentralization efforts under severe economic limitations. Under the administration of DNH, the *Direction Régional de l'Hydraulique et de l'Énergie* (DRHE) based in Ségou and the sub-regional *hydraulique* office in San are important governing bodies overseeing water management policy and providing support to the *communes* in the *Cercle de San*. The DRHE supervises private initiatives, making sure projects fall under national and regional law. Government representatives also provide training for elected officials in the *communes*, transferring competencies in local resource management based on state and regional policy. It is through programs such as PACT, that the materials are developed to support the efforts by DNH and other relevant stakeholders in resource management.

A number of other programs and NGOs operate throughout the *communes*, and in some cases, the study villages. For instance, the NGO *Fondation pour le Développement au Sahel* (FDS) and the World Bank-funded, government-directed, *Projet d'Appui aux Communautés Rurales* (PACR), have worked in villages such as Bankouma-Bobo to improve education and agricultural production storage. The NGO *Promotion de la Femme et de l'Enfant au Mali* (APROFEM) and UN-funded *Programme des Nations Unies pour le Développement* (PNUD), have conducted a wide range of development projects throughout the San area, many designed to promote capacity-building and economic opportunities for women. *Groupe Action pour le Développement* (GRAD), a research and devel-

opment agency working with international partners, also focuses on the empowerment of women and children, targeting marginalized populations in agricultural and herding communities in the area. The International Fund for Agricultural Development (IFAD) funded *Programme de Diversification des Revenus en zone non-cotonniére du Mali Sud* (PDR-MS) projects are designed to provide communities throughout the Ségou Region with alternative livelihoods and income-generating activities to support farmers affected by the declining cotton industry. A number of government programs, including *Fonds de Développement en Zone Sahélienne* (FODESA), *Projet de Gestion des Ressources Naturelles* (PGRN), *Programme d'Appui aux Service Agricoles et aux Organisations Paysannes* (PASAOP), and PACR, mobilize community efforts and provide technical support in agricultural and resource management initiatives. Support for microcredit and banking infrastructure in the San area is also provided by a range of NGOs, although significant support comes from *Projet d'Appui aux Structures Associatives et Coopératives dans les Cercles de San et Djenné* (PASACOOP), which is implemented by the banking institutions located in San and Djénne.

It is not uncommon to enter a village and learn that a wide range of nongovernmental and governmental agencies have implement development projects. It is rare, however, to find projects that have been implemented by partners in a long-term, collaborative manner. The exception to this in the San area is the World Vision Area Development Programs (ADPs). Peace Corps also has a strong presence around San, with several American volunteers placed in villages for two-year terms. The personal commitment of Peace Corps volunteers makes this an atypical form of development. These volunteers work in specific areas, which may include health, small business, education, natural re-

sources, or water and sanitation. Over the years, the volunteers in the San area have organized a number of water-related projects, including the construction of wells and latrines. However, while they make significant contributions, their scope of impact is generally isolated to a small number of villages in the region. Arguably, they are intended to be more of a mutually beneficial arrangement; an individual volunteer may gain as much culturally and socially as community members would, through both the implementation of projects and sharing the daily experiences of life in a rural village.

With the exception of WV ADPs and Peace Corps, the vast majority of other projects in rural communities in the San area are short-term in scope and implementation. For example, when the government provided funding for Mali Aqua Viva, after the borehole was drilled and pump installed, there was little or no follow-up with the communities. External programs and NGOs in the area often garnered the responsibility of providing limited community training and support for government infrastructure. Programs like BREESS have supported limited pump repair, but do not have the personnel or funding to manage repairs for all communities in the *Cercle de San* over the long-term. And although NGOs must become registered with the government to acknowledge their utility in public service, in practice, they have little regulation in Mali. Like in most countries, NGOs rely on self-regulation, which has varying degrees of legitimacy and incentive to promote best practices (Gugerty, 2008). Depending on the NGOs personal mandate or preferred development approach in the field, a community will have relatively more or less stake in their future. With this lack of resources, limited oversight, and poor coordination with local communities to create effective infrastructure management systems, it is not surprising local *communes* have such high numbers of nonfunctional water pumps (e.g., 60% of

pumps in Diéli *commune* and 70% in Baramadougou *commune*).

While villages may have varying levels of development and a range of external stakeholders in the processes, there are commonalities in the ways villages become involved in development initiatives. Because local development is intrinsically linked to natural resource management in rural Mali, it is important to understand these common paths. In the San area, three distinct ways a development project may be implemented were identified.

1. Formal collaborative planning: Local government and NGOs work together with communities to identify specific development needs. The PDESC is created with development partners and funding is scheduled in advance.
2. Clandestine projects: There are a number of instances in the San area, where a foreign NGO, religious group, or individual has approached a village to complete a project. The project usually involves short-term commitment and follow-up, and are generally small in scale. Some projects identified by community members as falling in this category included well construction and technology adoption (e.g., solar panels, computers, agricultural equipment).
3. Village initiative: The village chief and council either actively pursue assistance from partners (NGOs) or mobilize households to raise funds and implement a project without outside assistance. This process appears to be less common as it takes a great deal of persistence and personal resources from the village representatives.

The most common process for planning, designing, and implementing

projects in the San area is through the local development plans (PDESC). These plans provide a minimum level of development that has secured the attention and resources leading to community development. In these cases, limited funding from the government that is managed by communal administration is often designated for such projects. If a project is proposed to a community after the PDESC has been established, the PDESC does not exclude additional development initiatives from implementation. Projects will certainly arise during the actual PDESC program period[6], which was not uncommon for villages within the ADPs.

In formal collaborative PDESC planning, NGOs with long-term commitments to communities are actively involved in rural development project design. As a PDESC is being developed, the actual process can take shape in a variety of ways. At the onset of devising the PDESC, the mayor's office surveys the *commune* to determine where deficits exist among village social services such as health, education, microcredit, water, and sanitation. At this stage, active local NGOs may be consulted given their hands-on work in rural villages. In some instances, a village chief or council may also approach the mayor's office requesting certain infrastructure or training for their village. The mayor would then look to see what funding they had available through local government programs (for example, the *Agence Nationale d'Investissement des Collectivités Territoriales*, or ANICT), or contact an appropriate NGO in the area to assist with the funding and management of the project. The position of the mayor's office is important, guiding communities through the development process with limited resources. As a mayor from Koodugu ADP said, "My role is to educate people on development projects, to create awareness of opportunities. The *com-*

[6]The PDESC plans for the local *communes* at the time of the study were scheduled for implemented from 2006 to 2010.

mune can sometimes provide a financial contribution, but if there is not enough money, we can help organize the village to collect funds as well as ask for other sources of input, such as labor."

After the balance between needs and assistance has been identified, the development initiative for the village is formalized in the PDESC, along with the potentially hundreds of other projects planned for villages throughout the *commune*. Alternatively, a government agency or NGO may approach the mayor's office with specific projects and funding, and request assistance to find suitable recipient villages for the projects. Either way, the projects are associated with particular villages based on communal needs assessments and available resources to establish a five-year plan for the *commune*. The unresolved question is to what extent does the PDESC process involve disadvantaged members of the community versus the elites.

The PDESC notes the project objective (i.e., agriculture or health), specific activity planned, lead stakeholder (usually mayor's office), partners in the project (NGOs, government programs), village(s) involved, as well as the expected budget and proposed timeline. In addition to this organizational role, the communal office is intended to act as an intermediate for projects and an educator, conveying the ideals of Malian decentralization to local communities. An administrator from Koodugu ADP suggested that it was the role of the *commune* to enter a village prior to the NGO/project and sensitize village council on the importance of financial and labor contributions. He added that when it comes to specific projects, like a new borehole and pump, "Communal funds are simply not sufficient enough to either repair broken water infrastructure, or to provide new water points." What the *commune* can do is,"... link villages in need with

NGOs who are able to provide the financial support and technical expertise to develop these resources." This form of participatory development brings together the stakeholders in local development in the very early planning stages, but as mentioned previously, village-level involvement is typically restricted to the chief and village council. Once a project is further developed, implemented, and managed, it is often up to the main implementing partner, such as an NGO, to guide the degree of local community participation.

4.7 World Vision and community water development

World Vision (WV) arrived to Mali in response to the severe droughts during the early 1970s. The NGO provided the northern regions of Mali, including Tombouctou and Gao, with substantial amounts of food to counter shortages that followed multiple years of failed crops. Once established in the region, WV began to implement development projects in these and surrounding communities by the mid-1980s. Field staff were responsible for all aspects of the projects – from design to implementation – often offering technologies and resources they deemed appropriate with support from private donors. Earlier development efforts focused on agricultural production, increasing the number of wells in communities, and providing famine relief. Projects were provisional and not collaborative. As the nature of development discourse evolved, WV adapted to the changes and began implementing participatory development approaches. By the mid-1990s, WV began to establish ADPs, which secured the NGO's commitments to individual communities for at least 10 to 15 years. The approach also employed a more integrated form of development by building relationships with village leadership and working more closely with members of the

communities.[7]

With the MRWP and WAWI, an increasing number of water projects have been implemented in these ADP communities since 2003. Well rehabilitation, boreholes and pumps, latrines, committee organization and training, and health and sanitation sensitizations fall within the program's initiatives. To assist these efforts, the government provides training for water and sanitation committees and NGO staff. At times, the government works alongside WV conducting sensitizations in broader community settings. During the initial years of an ADP, there are usually more NGO staff to support the increased demands of establishing rapport and facilitating community participation in development projects. As the ADP develops with improved infrastructure and training, WV lessens staff commitments to transition the partnership, gradually increasing the participation of government representatives as training facilitators. Community volunteers and CBOs are fostered to play a larger role in community development as WV closes the formal ADP. Once an ADP phases out, a new program is established elsewhere in the region. According to an ADP manager, their goal is to create an environment such that, "When the ADP no longer exists, the systems required to support local development will be institutionalized and the government will maintain a presence to work with the communities."

World Vision field staff admit starting a new ADP can be challenging. The history of development initiatives in the area has been contentious at times, with varying degrees of community involvement and project success. Most often, community members have minimal participation in the development process. Typically, projects have been short-term and as soon as new infrastructure has

[7]Although WV integrated more participatory approaches to their development initiatives, the organization continues to employ a robust administrative framework to oversee all field activities.

been installed (in the case of government-constructed boreholes and pumps), the project partner disappears. This has proved to leave villages grossly unprepared for longer-term project management including maintenance, repair, training, and community organization.

In some cases, households come to expect development to be completed by outsiders, cultivating a *cadeau* or gift mentality. In other cases, bad experiences with previous projects results in a perceived sense of abandonment by those partners, which is not quickly forgotten. This often leaves villages feeling suspicious and doubting the intentions of NGOs like WV, despite a declaration to work with the village over a long period. Frequently, WV had to spend a great deal of time building trust in many communities because there was no concept of this type of village-level partnership. Even now, as many ADPs are maturing and nearing closure, there is a concern that people become complacent with their livelihood challenges. One staff member said, "People have to learn to understand that they can change life themselves," and that just passing along physical infrastructure each time a village needs something is simply not sustainable. Another administrator added that to make a project such as the installation of a borehole successful, "Communities must respect commitment." He said, "The community must be responsible for the project and must know that this is theirs, not the partners ... and partners [NGOs] must work on changing mindsets, which is a long-term process."

Additionally, Malian field staff who can speak the local dialect does not translate to instant trust, as rural villagers have a clear perspective of their community – who is inside and outside of their community. An educated field agent riding into the village on new motorcycle or in a white Toyota truck with a note-

book in hand is quite discernible. It is hard to dissolve the reality of the power they hold. Also, like in any occupation, there is a wide range of competencies among field staff. There are some who are constantly out in communities meeting with households and village leaders to ensure projects are moving forward, thus giving community members regular opportunities to contribute to decision-making. And there are others, who prefer significantly less interaction, some even borderline indignant of contact with the rural *milieu*. This in itself can have a significant impact on the success of a local project by threatening the valuable rapport built with collaborating CBOs and village leaders.

In order to maintain employee morale and promote skill development, WV imposes frequent turnover of field-based personnel. Hence, field workers overseeing activities in rural areas are relocated or given new project assignments every few years. However, the lack of continuity in NGO personnel in the field appears to have as many challenges as advantages. While it may indeed keep a worker motivated with new, changing opportunities, it also means that ADP managers must retrain staff more often to ensure consistency in the implementation of their ADP's range of projects and to foster an on-going collaborative environment. And although communities are generally grateful for WV's long-term presence, they do have to work to rebuild relationships with new staff on a regular basis. ADP managers retain their position in the ADP for longer periods than other staff members, which is likely a strong advantage to maintain continuity with partner communities.

NGOs like WV also work very closely with the local governments in their ADPs. As one manager said, "The gateway to development initiatives is through village chiefs, councils, and the mayor." The manager was referring

to the PDESC process and the importance of dealing directly with the village chief and council to identify potential projects. At the community-level, the degree of local participation relies almost entirely on village administration, with a very focused view of collaboration with the danger of benefiting an elite few more than the broader community.

4.8 Local communities

Much of this chapter has focused on the core partners of community development in the San area. At times throughout the assessment of these partnerships, the roles of local communities have been discussed. These roles, however, have mostly come from the perspective of various levels of government and NGO staff, as conveyed during interviews with these particular individuals. Missing from these discussions thus far, are the key modes of decision-making as experienced by households in local natural resource management. As discussed in earlier chapters, this process is highly influenced by the distinctly different roles of men and women in rural development.

Most communities in the *Cercle de San* have at least some exposure to development initiatives. This may be through the construction of a school or a cereal bank, training in microcredit, health sensitizations, or as this research explores, through water projects. The establishment of ADPs throughout south-central Mali for 10 to 15 year periods has created a unique relationship between local communities and NGO partners. Communities have a much stronger relationship with WV than with many other NGOs identified in the study area, and certainly more than with government agencies. During a focus group session in

Niamana-Masoumana, a local farmer noted, "The processes we use as a community to work with the government is the same as with an NGO, although NGOs like WV respond so much more quickly. When you make a request, they get back to you with a plan and we are able to communicate effectively."

Communities also perceive their relationship with WV as more valuable and trusting than with the government. Perhaps this is because the relationship has been developed and nurtured more consistently over time. With the government, many households have grown to doubt sincerity. Although this is slowly improving because of WV's integration of government training, these relationships are often limited to a small group of community members, such as a WATSAN committee or village council. As the speaker in the focus group above added, "With the government, they will withhold a project if the village has not paid all the taxes.[8] This is the government's criteria. So, until we have paid all of our fees, they will not help us." In the eyes of rural households, this can seriously prohibit development of infrastructure such as water resources, cereal banks, schools, and health centers. Taxation, managed now through communal administration, is still a relatively new system that is not entirely accepted by all households. This is a major challenge to the *communes* considering the lack of schools, health services, and other infrastructure and services found in these villages.

Because of the differing relationships between villages, NGOs, and government, households are also more likely to blame the government for the nonfunctional water pumps installed during the 1980s and 1990s. Households and councils indicated they felt grossly underprepared to manage the infrastructure,

[8]Households in the San area are taxed based on household occupancy, vaccinations for certain animals, and possession of firearms.

both because of a lack of training and a lack of financial support. However, an interesting trend identified across interviews was that these households were no less likely to suggest it was the village's responsibility to repair the pumps, than to divert responsibility to the government or an NGO. More data would be required to validate this observation.

Within the village itself, decision-making is highly structured and functions around traditional norms and behaviors. At the household level, both women and men discuss issues pertaining to the use of resources, needs for the children, and other household matters, but the head of household maintains final say in all decisions. Males, who head 89.3% of households in the Ségou region (Macro, 2010), are also more involved in community decision-making forums. The head of household is responsible for approaching either the *quartier* representative (in larger villages) or the chief and council directly (in smaller villages) with important issues or concerns pertinent to the well-being of their household. These issues may include requests for land, conflicts with another household, or questions about local resource use. If an issue is deemed to have impact on the community, an assembly is formed for discussion. Attendance is typically for heads of households, leaders of CBOs, the village council, and chief. Women may take part in most villages, although attendance is generally low and it is rare for women to speak during the meetings unless asked upon or represent a CBO. A WV field agent described this as a challenge saying, "At the beginning [of the ADP formation], it is difficult to get women to participate. At many meetings, it was just the men who would show up, but we sensitized the community and they began to join the men." Regardless, unless a women is representing a CBO, her personal viewpoints may at best be represented on behalf of her husband, if he shares her view and expresses it amongst his peers,

which is not always possible. Even among men, final decisions may involve the discretion of a few, such as the village administration.

In this research, CBOs are defined as either *traditional* or *new*. Those that have been in existence beyond the recollection of current generations are considered traditional. New CBOs are organizations or committees established more recently, often at the request of an outside agency implementing a development project (although not exclusively). While much of the discussion pertaining to water resource management in the San area refers to these new CBOs, the cultural significance of traditional CBOs remains important. The distinction between these forms of community organization highlights the entrained values of order and association, but also raises the issue of participation at the village and household levels.

Traditional village organizations as identified in the study communities included men's and women's associations, elder's associations, and youth associations.[9] Most men and women held membership with these traditional organizations at one stage of their lives, but their membership can be determined by social status as much as age. In the study villages, women could become members of the traditional women's association only once they entered into marriage. Additionally, the nature of these traditional organizations is often different from one village to another depending on local traditions or the size of the village. The most common difference in the structure of these associations is the division of traditional organizations by age group. For instance, the traditional women's association may include newly married young women up to menopause. After menopause, a woman would become part of an elder

[9]Members of youth associations are often solely male, ranging in age between their teens and 50s.

women's association. As men age, they would move from the men's youth association to an elder's association. In the case of new CBOs, a village committee is commonly formed during a new development project for the community, such as a cereal bank or school. This is typically under the recommendation of the development partner, which in the San area is most often an NGO, but may also be under the initial guidance of a government program.

When new CBOs are established in a village, the members are often suggested by the chief and council. These candidates may then be presented to their *quartier* or the entire village for approval by community assembly. It is unlikely that the heads of households would disapprove of the chief's suggestion because of respect for his position, nor is it likely that the nominee would reject this position. If an individual is asked by the chief to participate on behalf of his/her *quartier*, they accept because of a strong sense of duty and compliance to their chief's request. This is so, even if an individual feels they do not have the skills, or the time to participate.

In most cases, individuals are selected for committee positions based on their familiarity with the project, past experience on CBOs, as well as their level of education. Men are most frequently given the leadership roles in committees, with the exception of women-centered groups like a women's microcredit group or, of course, traditional women's associations. Both men and women interviewed agreed, unequivocally, this was both out of respect for men and because they believed most men had the capacity to take on such positions. This was not just because men tended to have more education, but respondents believed it was a man's nature to lead. These issues are discussed in more detail in Chapter 7, with regards to water and sanitation (WATSAN) committees.

During the interviews, household water users were asked about their knowledge of any water-related projects that had been implemented in the village, such as traditional well rehabilitation or installation of a borehole and pump. Of the seven villages who had experienced such projects, six of which included WAWI, only 50% had a somewhat clear understanding of the processes involved. Few of these individuals could remember the specific names of the stakeholders involved, including NGOs and government agencies, or the specific names of programs. This was indicative of the nature of the relationships between local communities and external partners, whether an NGO or government agency. The village chief and his council retain the majority of control in the manner and to what degree household's participated in development projects, and consequently, their role in local resource management.

4.9 Closing comments

Over the years, communities have maintained a great deal of autonomy, controlling their local natural resources along familial lines under the authority of traditional village governance. From the late-1800s through the mid-1900s, colonial rule by France resulted in a new form of governance, administrated by expatriates and a few elite Malians. Natural resources fell under the control of the colonial administration, resulting in drastic changes to land tenure among farmers along the Niger River as agricultural production was intensified for export to France. After independence in 1960, Mali transitioned through periods of Eastern bloc socialism and single-party military rule. During this time, natural resources became the domain of the ruling government. By the 1980s, the WB and IMF began working with the military government to spur economic growth

nationwide. This was at a time when the nation had been burdened with environmental disasters and political corruption, further deepening Mali's financial debt. Private investment led to increased resource extraction for export to donor nations, with natural resource management being under the executive control of the national government. A poor link between national and local governance challenged the ability of local communities to protect local resources.

Between the late-1960s through the early-1980s, as the region was struck with periods of serious drought leading to widespread famine, NGOs and international donors swept into the country. External partners supported the Malian government by providing much needed food supplies. Development efforts quickly expanded to improve water availability in rural communities and increase agricultural production. Government projects and private organizations led to the installation of numerous boreholes and pumps throughout the *Cercle de San*. As international NGOs such as WV rooted themselves in the country and broadened their initiatives to many communities in need, the development industry secured its place in Mali's rural development.

Even during this period of new rural development, the nature of projects was more transactional than participatory. But as the development discourse changed to one of greater inclusion, some project partners and government programs adapted appropriately. Concepts such as community-based, collaborative, participatory, and gender equality became mainstreamed into project proposals.

The historical role of government is significant to this analysis, but most notably because of Mali's more recent political context. The country rewrote its constitution in 1991 and had its first successful multi-party elections the follow-

ing year. By the time the participatory movement was common discourse in development initiatives, the process of democratic decentralization had begun, just a few years after democratization. The devolution of powers to local levels has had a major impact on local natural resource management. The roles of new local administrations and nongovernmental organizations have increased substantially. The devolution of powers, however, does not imply local communities have actually regained control of their local natural resources. While most village leaders hold day-to-day authority over local resource management, their authority would have little political power in the larger context of Mali's use of natural resources. This issue of authority is becoming evident in the case of large land and water-use contracts being devised with the *Office du Niger*, which will have tremendous consequences on the livelihood security of rural households.

Hellevik (2004) analyzed three local governments in Mali to evaluate the recent relationships between government authorities and rural villages. The analysis indicated that although new institutions are created to respond to decentralization, and arguably any other shift of power, they are not necessarily open, representative, or accountable to their communities. The reasons for this may include the elitism of local governance, the role of caste systems in determining local representation, or the existence of neo-patrimonial relations (Hellevik, 2004). A similar view suggests that though decentralization is intended to move power to the communities, those who gain this formal responsibility may not have the traditional power or experience to oversee local natural resource management (Onibon et al., 1999). The integration of traditional local institutions to change management processes in an appropriate manner thus becomes a critical factor in development (Rawson, 2000; Ribot, 1996).

Through the formulation of the five-year development plans (PDESC), each village must coordinate with the mayor's office and local NGOs to secure funding for basic community development in such areas as health, education, water, sanitation, and small enterprise. In this coordination, there is a unique balance between traditional patrilineal rule and decentralized civil authority. This system has an advantage of providing resource-poor communities with a means of ensuring access to improved capital, but it also gives foreign NGOs a prominent role in the process under the auspices of a relatively new form of governance. NGOs, who provide much of the resources (human, physical, and financial), retain the majority of power in choosing the path of development for individual communities. This has the potential to greatly influence the use and management of local natural resources.

In the political film documentary *J'y crois (I Believe In It)*, Malian scholar Dr. Moussa Djiré argues that the constitution itself lacks consistency with the true meaning of decentralization among the majority of people in Mali (van Rouveroy van Nieuwaal & van Nieuwaal, 2003). He explains that in Bambara, decentralization means *mara siki so* or "the return of power to its home." The constitution describes decentralization as "free administration for communities" such that, "communities and their populations are to take care of their own affairs." However, although traditional village administrations manage the day-to-day affairs of a community, communal administrations now retain the greatest decision-making capacity for local resource management under national policy. Djiré goes on to explain that decentralization, as it is implemented today, should be written in the constitution as *yema bo* or *mara tyema boli* – meaning to "diffuse from the center to the periphery." Djiré explains that, "If power is to actually return to the home, it should be returned to the house it left," that

is, to the traditional ruling classes within villages.

CHAPTER 5

RESULTS AND DISCUSSION: LOCAL CONTEXTS FOR RESOURCE MANAGEMENT

When you leave Segu you are on the edge of the desert. The earth is the color of ochre and burning hot. The grass, when it manages to grow at all, is yellow. But usually there is nothing but a desolate stony crust from which only the baobab can derive nourishment, together with the acacia and the shea tree, symbols of the whole region.

– Maryse Condé, *Segu* (Condé, 1987)

5.1 Introduction

The data introduced in this chapter present both the historical and existing state of water infrastructure and water resource use in the nine study villages in Sanké, Diéli, and Koodugu ADPs (see Figure 3.1). Each village narrative, based on interviews and focus groups sessions with local water users, chiefs, councils, and WATSAN committee members, describes a unique local context. This local context collectively serves to describe the range of experiences and perceptions stakeholders encounter in local water resource management in the region. Following the village narratives, which establish a contextual basis for the remaining analyses, a more detailed discussion of village water use identifies trends in water collection, use, and management across all households. Finally, a gendered analysis of the roles in local natural resource management is presented to examine not only the clear differences in water use and management among men and women, but with regards to local natural resources in general. This analysis explores the traditional roles and responsibilities among men, women, and children as productive members of their households – which are entirely

dependent on their natural environments – as well as how these roles intersect.

While this study specifically examines water resource management, an analysis of additional resource use among households is helpful to clarify the different resource needs of local stakeholders. It also identifies the different ways men and women may contribute to participatory development and decision-making within their households, as well as within their communities.

Interviews were conducted with the communal mayors representing each village, village chiefs and council members, and members of each water and sanitation committee, if any. In addition to two focus group sessions, local water users not affiliated with council or a water and sanitation (WATSAN) committee were interviewed in eight of the nine villages. Activity calendars and resource maps were completed by men and women in the community during focus group sessions, reflecting their perceptions of livelihood activities and their surrounding environment, contributing to the discussions on gendered resource management. These documents are provided for each village in Appendices D and E. As a reminder, chiefs, council members, and members of WATSAN committees were identified by purposive sampling. Local water users were selected randomly, except in Ténéni and Tiomporosso villages where the chief assisted in household identification. Members of focus group sessions were selected randomly in each village. More detail regarding the sampling process and site selection is provided in Chapter 3 (Methods). At the end of the sections below outlining ADP and village contexts, a variety of photos are provided to illustrate the various water sources and methods of water collection used within the study villages (Figure 5.1).

5.2 Sanké ADP

Table 5.1 provides a summary of *commune* and village demographics for Sanké ADP, including the state of local water infrastructure. As provided for each ADP, it highlights a number of important attributes of each study village and their *communes*, including population and water infrastructure data. These data identify the various water infrastructures available to the study villages, but most importantly, they also highlight the presence of functional and non-functional water infrastructures with respect to accessible populations. The Mali Rural Water Project (MRWP), on behalf of the West Africa Water Initiative and World Vision (WAWI-WV), aims to provide a safe water point for every 500 people using the preferred physical infrastructure (i.e., boreholes with hand pumps). Even considering clean, protected modern wells as safe water points, the water needs of rural villages are seldom met. The prevalence of non-functional water infrastructure greatly attributes to inadequate supplies of safe, sustainable water throughout these *communes*. In Sanké ADP, residents have greater access to borehole water, however, current infrastructure is not sufficient for the local populations. Modern wells are an important source of water in each of the study villages, and especially for the village of Somo where boreholes have not been drilled successfully.

5.2.1 Ténéni

A total of 50 individuals were interviewed in Ténéni in addition to interviews with San-based NGO staff to identify local demographics and water point availability. A summary of demographics and water infrastructures in the *com-*

Table 5.1: Characteristics of study villages in Sanké ADP

*Commune**	Ténéni	Niasso	Somo
Population	7015	12969	3729
# households in *commune*	1397	2198	803
# functional pumps	5	11	2
# nonfunctional pumps	3	1	0
# incomplete pumps	0	1	1
# modern wells	2	3	10
Village	Ténéni	Daelan-Sobala	Somo
Population	3843	674	2229
# households in village	637	111	275
Distance to San (km)	9	12	22
# functional pumps	3	1	0
# nonfunctional pumps	0	0	0
# incomplete pumps	0	1	0
# modern wells	0	1	9
# public traditional wells	1	9	6

**Commune* population data from the 2009 census completed in the *Région de Ségou* by the *République du Mali Institut National de la Statistique* (http://instat.gov.ml).

munes and study villages is provided in Table 5.2.

Ténéni, the capital of the *commune* of Ténéni, is situated northeast of San and about 6 km south of the Bani River (see Figure 3.1). The village is accessible by a single track path extending 9 km from San across a flood plain. During the peak of the rainy season, this route becomes flooded and difficult to traverse by vehicle. An alternative route that circumvents the floodplain is over 70 km from San. Ténéni's proximity to the Bani River provides local households with valuable resources. In addition to rice production along the flooded banks during the rainy season, fishing is a substantial income-generating activity for local households. Much of the fish is either sold in the village or brought to the weekly regional market held each Monday in San.

Table 5.2: Sample population in Ténéni village (Sanké ADP)

Sample	# of participants	Location	Interview Type*
Mayor and secretary general	2 (male)	Ténéni	Key informant A (group)
Chief and council, women's association representatives	12 (10 male, 2 female)	Ténéni	Key informant B (group)
WATSAN committee	6 (4 male, 2 female)	Ténéni	WATSAN (individual and by small group)
Household representatives	10 (5 male, 5 female)	Ténéni	Water resource user Part I (individual)
Focus group 1	12 (males)	Ténéni	Focus group session
Focus group 2	8 (females)	Ténéni	Focus group session

*interview protocol are shown in Appendix C

The village of Ténéni is believed to have been founded well over 1000 years ago and may be one of the oldest existing settlements in the *Cercle de San*. It is one of the larger villages in the area, with nearly 4000 people in three main *quartiers* or neighborhoods (Diassana Kin, Koita Kin, and Denon Kin). The residents of Ténéni do not recall any significant historical instances of drought, such that households did not have access to water for drinking, cleaning, or cooking. There have been periods of poor rains, which have limited cereal production, but the nearby river has always provided small fish and water that supplements traditional wells dug throughout the village. Nearing the end of the dry season, particularly in May, residents noted that some of the household wells would dry up. During such an event, the men of the household would either deepen their well, or the women would collect water from a neighboring private well

or one of the deeper public traditional wells (typically deeper than 10 m).[1]

Two hand pumps were installed by World Vision in 2006 to serve the community as a part of the Mali Rural Water Project water, sanitation, and hygiene (WASH) program, which during this period, was part of the WAWI-WV borehole program. Aprons and a trough adjacent to the pumps provided space to wash clothes and feed livestock without contaminating the pump area. Prior to the installation of these water points, a foot pump was placed on the school grounds in 1984 by Mali Aqua Viva[2] to provide school children with clean water. Very few residents use this water source since it is generally their understanding that the foot pump is intended for children and teachers.

Despite having two boreholes in the village, it is clear that not all households believe that pumps are advantageous to use. As one women recounted, "I live close [500 m] to the pump, but I have a household well that is only three years old." She felt as though the quality of water in the household well was perfectly safe. "Besides," she explained, "we have only sons to work in the fields alongside their father, leaving me alone to manage the household." It is far easier for her to collect water as she needs it directly from the household well, than make multiple trips to the pump on her own. For those using the boreholes, women agreed that they spend much less time collecting water than they did before the pumps. The time saved from household water collection is now spent tend-

[1]See Appendix A for definitions of water points as described throughout the analysis.

[2]Mali Aqua Viva was a project initiated by Père Vesperen between 1974-1993. Vesperen worked with the government's water agency (DNH) to provide borehole water to rural communities in Mali with funding from European NGO donors and the Government of Mali through *Caisse de Coopération*. Vesperen maintained the equipment, while the government provided technicians and organized local participation. Mali Aqua Viva also conducted a significant amount of work with the *Moyen Bani* project, partnered with the government's agricultural agency, DNA. After 1993 the project ended, although former employees regrouped into a type of private cooperative called a *Groupement d'Intérêt Économique* to continue some of the work. These employees were in the process of trying to form a private company as of late 2008 to carry on similar work in the rural water sector.

ing to vegetable gardens and small trade. These tasks remain labor intensive, but have significant value to these women by providing improved nutrition for their families and additional household income.

In contrast, another resident insisted she always used the newer water points because it was evident to her that the borehole water was safer for her family to drink. She, like many others in the village, believed that there was a noticeable reduction in the occurrence of stomachaches and diarrhea since they began drinking borehole water. That said, she was frustrated with the lines at her nearby borehole during peak collection times, equating it to a bustling market. She said, "Sometimes I want to beat the crowds, while at other times it is nice to meet and visit with people ... but mostly, I just want to get water quickly so that I can come back to my work." Although grateful for the two boreholes, many residents were concerned that three boreholes (two used by the majority of the population) were simply not enough for the village, leaving at least 1300 people per pump.

Men interviewed in Ténéni were extremely positive about the new boreholes, citing improved health for their families and a renewed sense of camaraderie among households within the village. One respondent indicated that the boreholes have "... given people hope and a reason to believe." Along the same line, another man suggested that a renewed hope from these new technologies have led to "... more participation in community gatherings now that households share common aims and thus have greater agreement on issues of community development." The *commune* hopes to further develop water resources in the village of Ténéni. At the time of field data collection, a new project with PACTEA was in early discussions to raise funds and construct a water

tower for the households. The basic infrastructure for such a project could cost between 75,000 - 100,000 USD in Mali (S. Diarra, WV, personal communication, December 6, 2010).

5.2.2 Daelan-Sobala

A total of 39 individuals were interviewed to examine the state of water management in the village of Daelan-Sobala. Table 5.3 and the following narrative outline local demographics and water point availability. The village of Daelan-Sobala is a short distance from the *goudron* (paved National Route [RN] 6), 12 km west of San (see Figure 3.1). The village is located near a flood zone south of a Bani tributary. The name Sobala indicates an older village. In this case, Daelan-Sobala was established before its neighboring village, Daelan-Sokourani. The relatively short commute to San provides villagers with regular access to the Monday market to sell farm products and small goods made in the household (e.g., clay pots and furniture).

The last recollection of severe water scarcity in the village was at the end of the dry season in 2003. During the previous year, the rains in the *Cercle de San* were lower than normal (Appendix F) and by the end of the following dry season in May, household wells were dry throughout the village. The men of the households dug wells deeper to access the lower water table, but the council noted that water in these wells has not returned to pre-drought levels.

Residents of Daelan-Sobala have access to five rehabilitated wells, a foot pump, and a hand pump. According to the Deputy Mayor of Niasso, WV conducted a widespread public well rehabilitation program in 2005 throughout the

Table 5.3: Sample population in Daelan-Sobala village (Sanké ADP)

Sample	# of participants	Location	Interview Type*
Deputy mayor	1 (male)	Niasso	Key informant A (individual)
Chief and council	5 (males)	Daelan-Sobala	Key informant B (group)
WATSAN committee	6 (4 male, 2 female)	Daelan-Sobala	WATSAN (individual and by small group)
Household representatives	10 (5 male, 5 female)	Daelan-Sobala	Water resource user Part I (individual)
Focus group 1	9 (males)	Daelan-Sobala	Focus group session
Focus group 2	8 (females)	Daelan-Sobala	Focus group session

*interview protocol is shown in Appendix C

commune, including the village of Daelan-Sobala. During that time, WV asked the chief and his council to establish a water and sanitation (WATSAN) committee to manage local water infrastructure. The foot pump located at the primary school was believed to have been installed by the government, possibly through the *Moyen Bani* project. Like in Ténéni, many residents felt as though this pump was limited for use by students and therefore avoided water collection from this source, even if it was closer to their household than the other pump.

At the time of the survey in 2008, the village was awaiting the completion of the first borehole drilled in the village, which at the time of drilling had been capped and secured. It is believed the government was also involved in establishing this borehole through *Moyen Bani*, although as for many projects in the village, no formal records exist. The uncompleted borehole had been drilled prior to the one by WV in 2006. When WV completed the newer borehole with

a hand pump, the WATSAN committee was asked to raise 100,000 CFA (just over 200 USD), which was placed in a bank account for use by the committee for pump maintenance and repairs.

During 2006, a modern well was also constructed in Daelan-Sobala. The chief and council had been approached by representatives from *Moyen Bani* indicating they wanted to install a well in the village. After calling a community assembly, a head of household volunteered a plot of land to the chief for the construction of the well, where it sits at the edge of the village.

The modern and rehabilitated wells have since provided valued sources of water for cooking, bathing, gardening, laundry, and animals, while the pumps are generally used for drinking. Residents fear over-using the pumps. Many people believe using the pumps for more than drinking water could lead to broken infrastructure and thus the loss of safe water for the village. The WATSAN committee collects 500 CFA (roughly 1 USD) from each household every few months for future pump repairs, although residents acknowledged there are many individuals within the village who refuse to contribute. As a result, there seems to be little confidence in the village's collective ability to maintain the pumps, perpetuating the fear of over-using local water infrastructure.

All of the women interviewed noted that the time it takes to collect water for the household each day has increased significantly since the boreholes were drilled. Each woman must now wait her turn to use the pumps. Despite wait time and concerns over repairs, households see the value in the pumps and modern wells. For instance, women believe that the use of drinking water from pumps has drastically reduced illnesses in the village. One women recalled, "I know the pump water is safe, so it is worth it." Prior to the WV borehole,

households in the village were trained in improved water handling techniques by a medical doctor from San. They were shown how to filter well water using a clean cloth, and how to add bleach to their traditional wells. Once the new pump from WV was in use, women said they did not spend as much time filtering well water even if they were using it for cooking, since the pumps provided drinking water. Additionally, the heads of households often chose not to add bleach to the household wells because of the added cost and increased use of the borehole water.

Like most traditional Malian villages, the residents of Daelan-Sobala have specific processes in place that contribute to community development. For instance, if a woman has a problem with one of the pumps, she tells her husband. The husband, as head of household, presents the issue to the chief and his council. If the problem cannot be resolved (e.g., a pump repair requires funds beyond the means of the council or WATSAN committee), the chief presents the issue to the *commune* mayor who seeks help from a local NGO (a partner of the village, such as WV). This process is clearly and enthusiastically understood by everyone in the village. In fact, many residents also believe that projects such as those initiated by WV, have increased unity within the village. The process of working with partners to a successful end, in this case accessing clean water, has given the community hope and a sense of pride for their village.

5.2.3 Somo

Somo, the second largest village in the study, provides an example of a community that has struggled with safe water provision having experienced mul-

tiple unsuccessful borehole attempts. Its location immediately adjacent to the main highway just 22 km southeast of San (see Figure 3.1) and the presence of the *commune's* mayoral office is undoubtedly linked to Somo's long history of NGO and government involvement. Interviews with 35 participants from Somo in addition to local NGO staff, offer insight into the historical context of water use in the village, including the challenges to establish safe water supplies by a number of different agencies (Table 5.4).

Table 5.4: Sample population in Somo village (Sanké ADP)

Sample	# of participants	Location	Interview Type*
Mayor, secretary general and council	6 (males)	Somo	Key informant A (group)
Chief and council	5 (males)	Somo	Key informant B (group)
WATSAN committee	1 (male)	Somo	WATSAN (individual)
Household representatives	10 (5 male, 5 female)	Somo	Water resource user Part I (individual)
Focus group 1	6 (males)	Somo	Focus group session
Focus group 2	7 (females)	Somo	Focus group session

*interview protocol is shown in Appendix C

From the time the primarily Bobo-ethnic (Bwa) village was founded, residents relied on hand-dug public traditional wells and seasonal tributaries located approximately 3 km to the east and west of the village. Now, there are over 150 private household wells, six public traditional wells, and nine modern wells. Shallow rock beneath the surface makes digging these water points a difficult task. Most of the public traditional wells in the community are believed to be at least 100 years old.

Despite the lack of boreholes, households have access to a number of modern wells, which if maintained, can provide a much safer source of water than old, unprotected public traditional wells. Modern wells are typically bored deeper than traditional wells and are lined with concrete. Modern wells are also protected with concrete berms and steel covers to prevent debris from entering.[3] A complete survey of historical water provision was not possible due to discrepancies between the mayor's office and village council regarding the names of past NGO and government agencies who had participated in water projects with the village. However, according to the mayor and his council, the modern wells were established by a number of different partners. Between the two groups, they noted three constructed by *Programme de Diversification des Revenus en zone non-cotonniére du Mali Sud* or PDR (providing water for the community gardens), one each by *Programme des Nations Unies pour le Développement* (PNUD), *Centre Rural de Développement de Milot* (CRUDEM), *Mission Catholique*, and a foreign individual donor, as well as one located at the mosque constructed by *Agence des Musulmans d'Afrique* (AMA). One of the village *quartiers* also organized and financed a modern well for their neighborhood.

After the severe droughts of the early 1970s, members of council and village residents recalled Mali Aqua Viva making a borehole attempt. Some residents insisted that the borehole was completed with a pump, which worked successfully for at least one year prior to losing water flow and ultimately being abandoned. It was not until 2006 when additional attempts were made to drill in the community. *Programme de Diversification des Revenus en zone non-cotonniére du Mali Sud* (PDR) made an unsuccessful attempt at a borehole, followed by two unsuccessful attempts by WV the same year. Challenging hydrogeological con-

[3]Definitions of water points in this study are provided in Appendix A.

ditions were noted by WV staff at the time. After four unsuccessful attempts to establish a functional borehole, it is unclear if further efforts will be made in the village. The basic cost of drilling a water point in Mali ranges from 7,000 - 10,000 USD (S. Diarra, WV, personal communication, December 6, 2010). Drilling cost can vary drastically from one region to another as drilling and completion are dependent on numerous factors, such as subsurface conditions and ease of access to the village. Water testing, pump installation, and community training are additional costs that must be considered in this type of water project. Sanké ADP was scheduled to close by the end of fiscal year 2010, therefore further drilling attempts by WV are unlikely in this particular community. Future water projects aside, residents seem to have accepted the village water situation. As one resident said, "They [spirits][4] have made it so, Somo will not have boreholes."

Resigned to the reality that borehole water may never come to their village, Somo residents insist the presence of modern wells has brought about significant changes in the village. Women believe having more wells eases daily water collection. A number of households also noted that the increased number of wells has stabilized water levels. Even when a household well dries during May and June, water can be accessed with minimal added effort from a neighbor, or at one of the nearby public or modern wells. Prior to the advent of modern wells, however, there was increased conflict among neighbors. People had to depend on one another's private household wells for water, and disagreements regarding responsible use and privacy were common. Since more women can draw water at the same time from the modern wells, some of the men said this

[4]It is not uncommon for reasoning to represent strong local spiritual or religious beliefs. For instance, two female respondents blamed the inability to excavate a household well deeper on the presence of defiant spirits in the well.

has reduced conflict among women. Despite these positive changes, there are still challenges regarding water collection among households.

The quality of community water sources having limited protection is extremely vulnerable to misuse and contamination. Even the modern wells may quickly become compromised if unsanitary buckets and ropes are used, or if random items are thrown down the wells by children (a concern expressed in all of the study villages). Over time, households become very conscientious of where they collect drinking water versus water used for cleaning and feeding animals. As a result, even though there are wells located extremely close to a household, women and children may have to walk several hundred meters to collect household water that is better tasting or at least appears clean.

Increased sensitization from WV, the local health center, and other NGOs has also introduced improved water handling techniques. Although not all households have adopted these techniques, and water disinfection is more of an acknowledgement than a practice, some households are filtering their drinking water. One resident added, "Getting new wells doesn't mean better health, people still have to use bleach [in wells]." A common sentiment was that although the village had little experience with boreholes, there is doubt that it would guarantee safe water. Even the modern well located at the mosque is not considered potable by residents, due to its poor taste. The garden wells are also frequently used to collect drinking water, perhaps because the wells are treated more frequently with bleach by the garden committee.

Garden wells allow women to grow vegetables throughout the year, which has increased small trade within Somo village. In general, men believe the increased supply of water has improved agriculture in the area by allowing them

to take on additional animals such as sheep, goats, donkeys, and oxen. Farmers in Somo expressed an additional positive outcome of the increased number of wells in the community: improved crop production. Fulani pastoralists now chose to travel through Somo to water their animals and the increased cattle manure has become a valuable source of fertilizer.

5.3 Diéli ADP

Table 5.5 summarizes of *commune* and village demographics for Diéli ADP, including the state of local water infrastructure. The *communes* and study villages in Diéli have a disproportionate number of nonfunctional pumps compared to working water infrastructure, with some of the pumps remaining in disrepair for multiple years. In addition to the poor state of the water pumps, none of the study villages have a modern well. If maintained properly, modern wells provide villagers with protected, accessible water resources for domestic use, which provides relief during periods of high-use at the pumps and a safe back-up source of water in the event of a pump breakdown. The following discussion details water usage and management among the three study villages in Diéli ADP.

5.3.1 Diakourouna-Nirosso

Interviews and group sessions were conducted with 47 participants in Diakourouna-Nirisso (Table 5.6). These sources, in addition to local NGO staff based in Diéli, provided the following assessment of local water resource man-

Table 5.5: Characteristics of study villages in Diéli ADP

*Commune**	Diakourouna	Niamana	Diéli
Population	11019	9696	13765
# households in *commune*	1690	1533	2255
# functional pumps	21	25	15
# nonfunctional pumps	8	2	23
# incomplete pumps	3	unavailable	0
# modern wells	5	3	0
Village	Diakourouna-Nirisso	Niamana-Masoumana	Tiomporosso
Population	1609	260	825
# households in village	136	21	68
Distance to San (km)	75	55	50
# functional pumps	2	2	0
# nonfunctional pumps	2	0	2
Duration of periods broken	6+ mo	3 days	1yr, 2yrs, 6 mo
# incomplete pumps	0	0	0
# modern wells	0	0	0
# public traditional wells	10	2	3

**Commune* population data from the 2009 census completed in the *Région de Ségou* by the *République du Mali Institut National de la Statistique* (http://instat.gov.ml).

agement in the community.

Diakourouna-Nirisso, the capital of its *commune*, is located 75 km southwest of San (see Figure 3.1). Beyond the village of Diéli, the trip to Diakourouna follows a rough single track trail. The village has experienced frequent periods of water scarcity over the years, with even many of the newer wells drying up during the months of May and June. Each year, the public traditional wells in the village are prone to collapse especially as the water table remains low during the dry season. During the 1970s and 1980s, the village struggled because of extremely limited water supplies. There was constant conflict around wells as women fought over every spilled drop. This created a general sense of malcontent among households because as one man pointed out, "When your wife

Table 5.6: Sample population in Diakourouna-Nirisso village (Diéli ADP)

Sample	# of participants	Location	Interview Type*
Mayor, secretary general and council	12 (males)	Diakourouna-Nirisso	Key informant A (group)
Chief and council	6 (males)	Diakourouna-Nirisso	Key informant B (group)
WATSAN committee	4 (2 males, 2 females)	Diakourouna-Nirisso	WATSAN (individual & by small group)
Household representatives	10 (5 male, 5 female)	Diakourouna-Nirisso	Water resource user Part I (individual)
Focus group 1	8 (males)	Diakourouna-Nirisso	Focus group session
Focus group 2	7 (females)	Diakourouna-Nirisso	Focus group session

*interview protocol is shown in Appendix C

is fighting with another woman, you become in conflict with that woman's husband."

Prior to the increase in household wells and boreholes, water collection was an arduous job. During times of water scarcity, women would walk 2 km to a neighboring village to collect water for the household, carrying it back in 10 to 20 L at a time. This task would take a full day. By the end of the dry season, women would sleep overnight alongside the distant wells to increase their chances of getting a turn to fill their buckets.

The situation in the village has improved since two boreholes were drilled by Mali Aqua Viva with government support in the mid-1980s, and as another two were installed more recently by WV. A few of the public traditional wells

were also improved by WV during the past few years. The foot pump located at the school was still operational at the time of the study, but nearly every respondent indicated that the water at this source was not palatable. People living near this source did not use the school pump water to drink, even though they were told testing had confirmed the water was safe. In total, two of the four pumps were broken at the time of the study, including one foot pump and one hand pump. Although the pumps had not been functioning for at least six months, there was no consensus among council, households interviewed, or WATSAN regarding responsibility for repair. Overall, there was a strong sense among residents that the borehole projects had been unsuccessful. The reasons for failure were attributed to a lack of pump maintenance, having unpalatable water from one of the boreholes, and limited access by a small proportion of the village to the two functioning pumps.

The mayoral council expressed their preference for foot pumps, stating that those particular boreholes seemed to have maintained greater water pressure and experienced less frequent break-downs than the more recent hand pumps. Residents were not concerned with difficulty of use, but rather the inability to use the two broken pumps, resulting in congestion at the functioning pumps during peak collection times, which typically are in the early morning and early evening. One women said she would like to use the nearby pump more frequently, but often resorts to her household well to avoid the lines for borehole water. Four other interviewees said they simply choose not to use the pumps, because the functioning pumps were too far away from their households. Although there was a functioning pump less than 100 m from one of these respondent's home, she preferred the accessibility of her private well.

When WV installed the hand pumps, they also created a women's community garden. Both men and women expressed their excitement for this new development in the village, which they attribute to the arrival of the WV pumps. This was not a random connection made by residents. Women's gardens are just one component of WV's multifaceted program (ADP) and not surprisingly, due to the nature of the project, often complemented the addition of new or improved water sources in the community. The general consensus among interviewees was that the number and size of household gardens had also increased since the two WV pumps were installed. While the garden project had no doubt provided women with increased skills to garden within their household compounds, the increased water sources made this work far more feasible. Even with two broken pumps, the number of people sharing household wells for all their daily needs had decreased significantly. More water could then be used for gardening, which generated valuable additional household income through the sale or trade of vegetables at local markets.

While constructing the garden space, WV assisted the women in establishing a garden committee to manage maintenance and plot assignments. According to women interviewed, this process increased their organizational abilities. Having a garden committee in addition to a traditional women's association, women interviewed indicated they felt motivated to increase their local participation. This included organizing and attending more women's meetings and organizing themselves into groups to work in men's cotton fields. The extra money raised from collective activities was saved for social activities in their respective *quartiers*.

Like other villages benefiting from borehole water, all of the people inter-

viewed in Diakourouna-Nirisso believed the new water sources had significantly improved health, especially among children. Besides hygiene and sanitation sensitizations conducted by WV, the village also benefited from the presence of the communal health center (CSCOM). Medical staff routinely counseled their patients individually and provided broader sensitizations on improved water handling techniques to the general public during community meetings. Six out of 10 households involved in the survey indicated they filtered water for drinking and cooking 'very frequently' when not obtained from a borehole.

The men who participated in the focus group session felt that over the past five years, the population in Diakourouna-Nirisso had decreased as a result of migration for employment. Men and women commonly left the village at some point during their youth to earn additional income for the family. Young men would leave for a few months at a time after each annual harvest to work primarily as casual laborers in urban centers throughout Mali and neighboring nations, including major ports in Côte d'Ivoire. According to participants in the women's focus group session, young women, mostly between ages 12 to 15, would also migrate to Bamako for several months each year to find employment as household laborers. Despite the migration, they acknowledged that borehole water had a complex, but positive impact on community well-being. According to both women and men interviewed, new sources of water for the village were not just an issue of increased accessibility; the provision of water had a signifiant trickle down affect. More water meant the ability to increase animal production. Participant's believed that drinking safe water also translated into a healthier population, one that was able to work harder. The cumulative effect has become a more prosperous community. The challenge for Diakourouna-Nirisso is to manage the infrastructure so that these improvements in water

provision are sustainable.

5.3.2 Tiomporosso

In addition to Diéli-based NGO staff, 61 individuals from communal government and the village of Tiomporosso participated in the study (Table 5.7). The village is easily accessible off the *goudron* (RN 6) about 50 km southwest of San (see Figure 3.1). An examination of local water availability and use is provided below.

Table 5.7: Sample population in Tiomporosso village (Diéli ADP)

Sample	# of participants	Location	Interview Type*
Mayor, secretary general and council	18 (17 males, 1 female)	Diéli	Key informant A (group)
Chief and council, Women's committee representatives	12 (8 males, 4 females)	Tiomporosso	Key informant B (group)
WATSAN committee	7 (3 males, 4 females)	Tiomporosso	WATSAN (individual & by small group)
Household representatives	10 (5 male, 5 female)	Tiomporosso	Water resource user Part I (individual)
Focus group 1	6 (males)	Tiomporosso	Focus group session
Focus group 2	8 (females)	Tiomporosso	Focus group session

*interview protocol is shown in Appendix C

Before households began digging their own wells, water was collected using public traditional wells in the village of Tiomporosso. During the droughts of the 1970s and 1980s, the village experienced significant water scarcity. Women

had to walk about 1.5 km to a nearby village to collect water for their households. Individual households began digging wells inside their compounds about 30 years ago and now, nearly every household has a private well. Many of the wells are dry from May through June, forcing households to find alternative means of water collection. Most households rely on assistance from neighbors and use public traditional wells for all water needs. Respondents recalled frequent conflict between individual water users until households established more private wells to increase local water availability. The installation of boreholes further relieved the stress of water collection during the dry season.

Two boreholes were drilled in the mid-1980s, by Mali Aqua Viva with government funding, which were completed with foot pumps. One was installed at the school and the other was placed in the heart of the village, near the mosque. When WV rehabilitated and protected (as defined in Appendix A) two of the public wells, they also replaced the broken foot pump near the mosque with a hand pump. The pump at the school was viewed as student property, therefore most households tended to use the other pump located more centrally within the village. As a result, the central pump was crowded during peak collection times (early mornings and evenings), and at times, the congestion caused disagreement among water users. Women said the hand pump was easier to use than the foot pump, and considerably easier than drawing water by hand, but the trade-off was always having to wait. One respondent said that her sisters would often return from the pump without any water because they had simply given up after waiting so long. Part of this congestion was also because the pump had designated hours of operation. The pump was only opened for water collection twice daily (06:00 - 08:00 and 16:00 - 18:00) and was locked by WATSAN at all other times to prevent tampering and misuse. There has never been

significant conflict over this community policy, as it had become an accepted part of using the pump. However, every individual interviewed indicated the long waiting times were a serious frustration.

At the time of the study, the school pump had been broken for more than a year, while the hand pump had been broken for approximately six months. Since the pumps were not functioning, most of the residents were using either private household wells or the wells in the community garden to collect drinking water. All of the residents interviewed felt that when the pumps were functioning, health improved considerably in the village. Residents indicated they were worried health conditions would deteriorate again, now that the pumps were broken, and they were taking more precautions. Drinking water is now filtered by many women, including among all of the interviewees' households. Filtering is done with a piece of cloth, which likely filters little more than debris visible to the eye but is recommended by the local health centers (CSCOMs). This precaution became more common when households recognized that borehole water was noticeably cleaner than well water. Households were trained to treat their wells with bleach, although many people acknowledged they had stopped doing this because of the added expense. With the presence of a local health volunteer, there also had been more frequent sensitizations regarding water handling, hygiene, and sanitation. This has prompted households to use more protected water sources for potable purposes, while water for other household needs, construction, and animals continued to be collected from public and household wells.

There was overwhelming agreement among households that the pumps should be repaired in Tiomporosso, and seven of 10 interviewees felt as though

the village and local council leadership was responsible for repairs. Household members resented the loss of borehole water, which was for many households, the only source they now trusted for potable water. Based on interviews with water users, local government, and WATSAN members, it appeared there was a great deal of misunderstanding with regards to how the village should proceed with repairs. Local government and WATSAN insisted funds be collected from each household to hire a communal repairman and purchase parts. Contrary to the perception of local leaders, most households did not argue about this need, as the majority of water users interviewed (70%) said they (wives and husbands) would be willing to contribute funds to the WATSAN committee to handle repairs. Although it is true that initially some individuals may not have wanted to contribute money for repairs, enough time had passed without the added security of borehole water, according to those interviewed. Community members acknowledged their households would be more than willing to contribute financially to finally regain access to a more secure source of water, but WATSAN had not returned to collect. Only two respondents felt that it was an NGO partner's responsibility to repair the pumps, because they insisted that their households did not have enough money to contribute.

Smallholder gardens are important for local trade and subsistence in Tiomporosso. Gardens are located throughout the village in private households and along the paths to surrounding cropland. Residents believe this has been possible because of the increase in private wells throughout the village. The presence of boreholes has not had an impact on gardening for two reasons: the single pump was never viewed as sufficient for the population, and it has been broken down for extended periods of time. Vegetables are grown for household consumption through the first half of the year using well water. After the rains

begin and household labor is needed in the fields, vegetables are purchased at the local markets in Diéli and Niasso. As long as the rains are sufficient and the household structure is able to accommodate shifting labor requirements during the cropping (rainy) season, some households continue gardening year-round.

5.3.3 Niamana-Masoumana

The exploration of water use in village of Niamana-Masoumana included 36 interview participants (Table 5.8). This village is located approximately 55 km southwest of San (see Figure 3.1). For many years, its people have relied on two public wells for water. All of the households shared these water sources for drinking, cooking, cleaning, building, and watering animals. About 15 to 20 years ago, households began digging their own private wells despite the challenges of sandy, unstable soils and a water table highly susceptible to rainfall fluctuations. During the dry season, women would often wait for hours until the wells recharged enough to collect a bucket of water for the household.

The first borehole in Niamana-Masoumana was drilled during the early 1990s by the government. For reasons unknown to the local council, the foot pump was not placed on the borehole until almost 15 years later. Although the project took many years and the quality of water was initially poor (until regular use flushed the borehole), accessing safe water was a tremendously positive livelihood change for residents. Shortly afterwards, a second borehole was drilled and completed with a hand pump in 2006 by WV. While the water point was being completed, WV had the village raise 100,000 CFA (200 USD) from the households, which was returned to the newly formed WATSAN committee and

Table 5.8: Sample population in Niamana-Masoumana village (Diéli ADP)

Sample	# of participants	Location	Interview Type*
Mayor	1 (male)	Niamana Sobala	Key informant A (individual)
Chief and council	5 (male)	Niamana-Masoumana	Key informant B (group)
WATSAN committee	5 (3 males, 2 females)	Niamana-Masoumana	WATSAN (individual & by small group)
Household representatives	10 (5 male, 5 female)	Niamana-Masoumana	Water resource user Part I (individual)
Focus group 1	8 (males)	Niamana-Masoumana	Focus group session
Focus group 2	7 (females)	Niamana-Masoumana	Focus group session

*interview protocol is shown in Appendix C

placed into a bank account for pump repairs and maintenance. This process was well-understood by residents, both men and women. Acknowledging that the funds collected from households were an important contribution towards future repairs, a water user further explained, "We know that the money collected [from households] wasn't even close to the cost of the borehole or pump, but it showed community commitment." At first, the WATSAN committee stationed women at the pumps to sell water by the container (10 CFA per day, then 5 CFA per bucket) in order to generate regular funds for repairs. Residents found this to be far too expensive, so the WATSAN committee started collecting 100 CFA each month from households. Not every household has agreed to contribute this fee, but as another water user suggested, "We need to sensitize the people on the importance of safe water and its related costs."

A preference in water point technology was also made abundantly clear among local water users. Several residents indicated they prefer using the hand pump over the foot pump for water collection. Women in particular found the hand pump physically easier to operate and cleaner, since people did not remove their footwear to operate the foot pump. The mud around the foot pedals can also damage the levers, rendering the pump inoperable.

After the second pump was installed, the increase in available water made a recognizable difference for women in the village. One man noted that the water projects have targeted women in a very positive way by providing education and new opportunities for community management. He said, "The projects are teaching women how to be a part of WATSAN and how to organize themselves around water resources." The second borehole project also came at a time when WV was implementing a complementary project – a women's community garden. With the assistance of the partner NGO, women quickly gained experience in small-scale gardening and learned of the nutritional benefits of vegetable consumption. The sale of vegetables has also provided women with extra income to contribute to the household needs. Profits from the women's garden had been going towards household contributions to the WATSAN fund. This was a benefit well-acknowledged and appreciated among males in the community. Residents of Niamana-Masoumana also attributed the addition of the boreholes to stabilizing the static water table, especially during the dry season when water levels drop significantly in shallow household wells. When the pumps were functioning, women also felt they had saved significant time using the pumps rather than drawing water for household needs. According to interviewees, these changes had allowed more households to have their own gardens, to expand the size of gardens, and to grow produce year-round.

While it is difficult to verify a direct link between the new boreholes and health in any of the study villages, residents believe borehole water has had a positive impact on people's health. As a result, interview participants believed the improved health was having a broader economic impact on households in the community. One male respondent said,"When we drink bad water, it is easy to feel sick all of the time. Drinking the pump water makes me feel good and I am able to work harder on the farm." Another man in the village had a similar sentiment saying, "When you are sick you cannot work and must purchase medicines...so bad water reduces economic activity."

Both men and women in the community indicated that the water projects, especially over the past few years working directly with a partner NGO, have improved attendance at community meetings and increased unity. As a women described while pounding millet for her family's evening meal, "The process of seeking help for the [new] source started to strengthen the community, but actually having safe water for all made it strong." For some communities, the process of rural development is leading not only to improved resource availability and management, but is also building social capital and strengthening relationships.

5.4 Koodugu ADP

Table 5.9 is a summary of *commune* and village demographics for Koodugu ADP, including the state of local water infrastructure. Like Diéli ADP, there are a large number of nonfunctional pumps throughout the ADP. The more densely populated Téné *commune* has the largest number of functional borehole infras-

tructure, most of which are located in the *commune's* capital, although the number of pumps per capita is insufficient.[5] In the study villages, there are no functional pumps and only one modern well. Although various NGOs and government agencies have constructed a modest number of pumps and modern wells in the *commune*, the absence of WAWI-WV's efforts to provide improved water infrastructure is visible in this newly-formed WV ADP.

Table 5.9: Characteristics of study villages in Koodugu ADP

*Commune**	Baramadougou	Téné	Fion
Population	9646	22684	4985
# households in *commune*	1789	4458	1110
# functional pumps	5	22	8
# nonfunctional pumps	12	8	1
# incomplete pumps	0	0	0
# modern wells	1	2	5
Village	Paparoné	Bankouma-Bobo	Pona
Population	855	927	767
# households in village	119	89	122
Distance to San (km)	81	55	90
# functional pumps	0	0	0
# nonfunctional pumps	0	2	1
Duration of periods broken	n/a	5 yrs, 6 yrs	periodic mo, 1yr
# incomplete pumps	0	0	0
# modern wells	0	0	1
# public traditional wells	5	5	4

**Commune* population data from the 2009 census completed in the *Région de Ségou* by the *République du Mali Institut National de la Statistique* (http://instat.gov.ml).

[5] As mentioned earlier, WV's goal is to provide a preferred water point (e.g., pump or modern well) for every 500 residents.

5.4.1 Paparoné

In addition to San NGO staff, 41 individuals from communal government and the village of Paparoné participated in interviews to explore the state of water resource management in the village (Table 5.10). A WATSAN committee had not be formed in the village, and was therefore excluded from the interviews. Paparoné is a medium-sized village located 81 km northeast of San (see Figure 3.1). After reaching Téné along 50 km of paved roads, the village is accessible by heading northwest on a single track trail for roughly 30 km.

Table 5.10: Sample population in Paparoné village (Koodugu ADP)

Sample	# of participants	Location	Interview Type*
Mayor and secretary general	2 (males)	Baramadougou	Key informant A (group)
Chief and council	6 (male)	Paparoné	Key informant B (group)
WATSAN committee	0	no committee	WATSAN
Household representatives	10 (5 male, 5 female)	Paparoné	Water resource user Part I (individual)
Focus group 1	13 (males)	Paparoné	Focus group session
Focus group 2	10 (females)	Paparoné	Focus group session

*interview protocol is shown in Appendix C

Residents interviewed recalled a time when water was plentiful in nearby tributaries. Seasonal rainfalls provided more than enough water for local agriculture, and for many years, the households were served by the five public wells. Over time, however, rainfall has lessened, streams receded, and the wa-

ter levels in wells have declined. Now, according to village council, there are at least 100 private traditional wells located throughout the village in household compounds. Some of the five public wells are believed to have been constructed 200 to 300 years ago when an Arabic teacher settled in the area. Households described water in the public wells as varying significantly in quality (appearance, odor, and taste). Because of the declining quality, water for cleaning, animals, laundry, and house-building came from public wells. Water for drinking, on the other hand, was only collected from the newer, private household and garden wells. Women and children collected water in the morning and late-afternoon, and stored it in clay receptacles.

Vegetable gardening was practiced in the village of Paparoné, contributing to local small-trade. Because the soil within the village is very hard and compacted, many of the family gardens were located in the surrounding plains rather than within private household compounds. This village did not have a community garden, but many households participated in collective activities. Despite the absence of outside partners, the village had a strong system of local governance and traditional CBOs working towards community development. Travel outside of Paparoné for seasonal employment has increased awareness among households of available innovations and technologies. They have watched neighboring communities employ a variety of efforts to improve their livelihoods, from education to agriculture. Representatives from the women's association indicated that women in the village had already raised 500,000 CFA (1000 USD), which was being kept in a bank account to assist the men and local leaders with development initiatives. Residents indicated that although they felt safe water was important, they saw greater value in developing education facilities for children and improving access to health care.

With regards to local water resources, the village has improved a number of their traditional wells on their own initiative. In 2006, the public traditional wells were protected with tall, cement berms to prevent debris and runoff from entering, using funds collected by the households and traditional associations. Women and men were also well-aware of improved water handling techniques, such as filtering and disinfection. Such practices had not yet been adopted by all of the households, but existed because of the constant exchange of knowledge between households and extended families in the area.

Like many of the other study villages, households had preferred water technologies in Paparoné. The mayor of Baramadougou said his constituents preferred hand rather than foot pumps. The households and village council in Paparoné, however, were hoping to bypass these technologies. The council was trying to engage an NGO partner to construct a water tower system in the village. A tapped water system was viewed by residents as the only technology with the capacity to serve the entire village, ultimately improving health and allowing more well water to be designated for gardens.

The interviews identified water-related conflict in the area that had occasionally occurred between villages relying on shared seasonal streams and ponds during the rainy season. Disagreements, most often regarding fishing rights were resolved among the village councils. Conflict had also existed between pastoralists and cultivators, as herds were moved through cropland towards local water sources. When a disagreement cannot be resolved among conflicting parties, it is presented to the chief and council for resolution. These have been long-existing issues in the area, which may be exacerbated by growing populations and reduced annual rainfalls.

5.4.2 Bankouma-Bobo

A total of 27 individuals were interviewed in Bankouma-Bobo, including household water users, focus groups and representatives from the *commune* (Table 5.11). Like the village of Paparoné, Bankouma-Bobo does not have a WATSAN committee to manage water infrastructure and water-related health and hygiene issues. The village is located 55 km northeast of San (see Figure 3.1). It is accessible by traveling about 5 km along a single track path north from the town of Téné, the communal capital and closest major market center.

Table 5.11: Sample population in Bankouma-Bobo village (Koodugu ADP)

Sample	# of participants	Location	Interview Type*
Mayor and secretary general	2 (males)	Téné	Key informant A (group)
Chief and council	4 (males)	Bankouma-Bobo	Key informant B (group)
WATSAN committee	0	no committee	WATSAN
Household representatives	10 (5 male, 5 female)	Bankouma-Bobo	Water resource user Part I (individual)
Focus group 1	5 (males)	Bankouma-Bobo	Focus group session
Focus group 2	6 (females)	Bankouma-Bobo	Focus group session

*interview protocol is shown in Appendix C

Much of the *commune* is susceptible to drought during the dry season, particularly the villages located towards the northeast of the *commune*, including Bankouma-Bobo. Low annual rainfall causes the water level to drop in wells

limiting water use, although rarely severe enough to leave wells completely dry. Settled around a single public traditional well, Bankouma-Bobo eventually constructed four additional wells. The original traditional well was still revered as a sacred water source in this primarily animist, Bobo-ethnic (Bwa) village. Some people believe the well 'just appeared' when the first households were established. Built on an elevated mound and protected by clay, only women collect water from this source. Water was collected by women standing barefoot on the mound using a traditional calabash, after prayers were offered to the spirits of the well. A photo of the original traditional well in Bankouma-Bobo is shown in Figure 5.1 H, along with a variety of sources and uses of water in the study villages.

Included in the government drought response, Bankouma-Bobo received two boreholes in 1984 completed with hand pumps. It is believed that a PDR-MS project installed the pumps under the direction of Mali's Ministry of Agriculture (DNA). The village provided a small amount of labor for the projects and cooked for the workers. Only one of the pumps was deemed potable by the residents due to the bad taste of water from one of the two boreholes. The unpalatable borehole water remained an important source for watering animals, especially because it relieved stress on water supplies from private wells during the dry season. The taste of the other borehole water was preferred over any of the wells located in the village, according to residents. The NGO, BREESS, having a history in the area organizing local water committees and arranging for households to set aside funds for pump repairs, was believed to have assisted Bankouma-Bobo in these areas in the past. Many years ago, a water committee was formed in the village with a small group of individuals trained in basic maintenance. The committee had organized two pump repairs, but

gave up when households started to refuse regular contributions for such work. Residents recalled membership consisting of a group of elders, who had since passed away or moved from the village. During the interviews, no individuals were identified as having experience or knowledge regarding the activities of the now defunct water committee.

Both pumps had broken down in Bankouma-Bobo: one had been repaired three times, while the other had required a single repair. The village council indicated that the communal repair person in Téné had serviced the pumps in the past, after the chief and council raised village funds. At the time of the study, the two pumps had been broken down for five and six years, respectively, and there was no indication that the community would work towards future repairs. All of the households interviewed said that because they have had to go such a long time without safe water, they would like to see the pumps finally repaired. All of the households said it was their responsibility to contribute to these repairs financially, but that it has not happened because the issue has never been raised for community discussion. The village council said they had not pursued further repairs because households would not likely pay for them. The lack of communication and the absence of a management committee certainly appear to have contributed to the deteriorating state of the pumps over the past several years. Besides the broken pump infrastructure, there are no modern wells in the village.

To conduct health sensitizations, the *commune* has used staff from the community health center, or *Centre de Santé Communautaire* (CSCOM), and a local radio station that reached residents with access to a radio in Bankouma-Bobo. The mayor of Téné noted that the local CSCOM received an award in 2007 from the

health ministry because of their work, which included broad efforts to provide sensitizations on improved potable water handling techniques. Households in the village of Bankouma-Bobo had been trained by CSCOM to filter well water, as well as to add bleach to wells, although most people admitted they usually only filtered the water. Through various development projects, APROFEM has provided additional sensitization regarding water and health related issues for women in the village. A village-based microcredit program was also organized by APROFEM that generated a number of new opportunities for women in the community, particularly related to small trade. Vegetables were sold and traded by women in village as well as at the weekly markets in larger neighboring villages. Many years ago, long before the village received the boreholes, one of the households started a small garden after learning about the practice during a visit to another village. Since then, many of the households started to do the same in Bankouma-Bobo and gardening has become a year-round activity. Private plots for women were arranged by their husbands, who ask the chief for permission to use the land if they did not have a suitable location of their own.

Water-related conflicts more commonly occurred around the use of local fishing ponds. As ponds developed from the swelling tributaries during the rainy season, neighboring villages sometimes disagreed on access and use. Conflicts had also been caused by people using land without permission. These issues were managed among traditional resource management committees, the chief, and village council.

According to interviewees, a significant number of individuals in the village have traveled abroad for work. Members of households had a strong awareness of various technologies and practices in water resource management because of

their mobility, even though these innovations were practiced only modestly in the community.

5.4.3 Pona

Interviews in Pona were limited to the communal mayor's office in Fion and Pona's village chief and council. A total of 12 individuals participated (Table 5.12). Additional interviews were not possible in this village because of access difficulties associated with the beginning of the rainy season. Pona is another village in the area believed to have been settled more than 1000 years ago. The village is located about 90 km northeast of San, 40 km of which follows a trail across the floodplains from Téné (see Figure 3.1).

Table 5.12: Sample population in Pona village (Koodugu ADP)

Sample	# of participants	Location	Interview Type*
Mayor, secretary general and registrar	3 (males)	Fion	Key informant A (group)
Chief and council	9 (males)	Pona	Key informant B (group)
WATSAN committee	N/A	N/A	WATSAN
Household representatives	N/A	N/A	Water resource user Part I (individual)
Focus group 1	N/A	N/A	Focus group session
Focus group 2	N/A	N/A	Focus group session

*interview protocol is shown in Appendix C

Much of the *commune* is situated on a plateau, making it difficult for many of the villages to access water. The mayor's office indicated that most large diameter wells must be 16 to 20 m deep before the water table is found. Numerous borehole attempts have been made in the area with variable success. Almost all villages were founded near a surface water source, although many of the original streams and ponds have since dried. Like the other study villages, once the population of Pona outgrew the public traditional wells, private household wells were dug throughout the village. The village of Pona has four public traditional wells. During the end of the dry season, water levels drop enough to require further digging and deepening of the wells. After the lower rainfalls experienced in 2003, many households were forced to deepen their wells to access water. The locations of these wells were often determined using traditional knowledge. According to local leaders, the presence of a termite mound signified that shallow water may be found, making it an ideal location to dig a well.

Pona and surrounding villages were also adversely affected by the droughts of the 1970s and 1980s. In response, the government drilled boreholes in a number of villages, including one in the village of Pona. The borehole was eventually completed with a hand pump. Another project had started a borehole and then decided to widen it into a modern well. Water was collected by women and children in the village, during the early morning and afternoon.

Households generally equated newer water infrastructure with improved water quality. Specifically, residents preferred the taste and clarity of the borehole water. A number of adults added that children were excited by pump technology and were quick to assist local elders in water collection, likely be-

cause the technology was unique and accessible to their generation. Despite this, people seem to prefer modern well technology.

Although study participants felt pumps offered better water quality because of their protection, they preferred the new large diameter wells. This preference was logical in that more women could use the source at the same time. The modern wells also provided a constant water source, whereas the pumps were susceptible to breakage. The pump in the village, for instance, had broken down four times. On three occasions, the local water committee (believed to be organized by BREESS) collected funds and contacted the repair person located in Téné. The village council indicated that the most recent break down, which had rendered the pump nonfunctional for the past year, would eventually be repaired. However, other financial commitments had put the pump repairs on hold. Money that would have normally been used for pump repairs was redirected by village council to cover critical reparations to the local school.

5.5 Household and village water use

The semi-structured interviews conducted with households revealed a number of trends regarding local water use and management. Quantitative findings were supported by the narratives of local water users in each of the eight villages where these interviews took place.[6] Data included the different roles in water collection, water point use, pump maintenance responsibility, and historical water-related conflict.

[6]In the village of Pona (Koodugu ADP), interviews were only conducted with the village chief and council.

Figure 5.1: Different water points and usage within study villages. (A) Demonstration of filtering water for drinking and cooking in Somo. (B) Boy collecting water for livestock in Somo. (C) Traditional well rehabilitated by community in Paparoné. (D) Modern well located at mosque in Somo. (E) Woman carrying 20 liter bath of water in Daelan-Sobala. (F) Children collecting water in Ténéni using a hand pump and *bidons*. (G) Preparing to transport water using a donkey and *charette*. (H) Woman collecting water using a *calabash* at the original traditional well in Bankouma-Bobo. (I) Collecting water in the Diakourouna-Nirisso community garden.

Women in the study villages continue to be primarily responsible for water collection (Figure 5.2 A), an activity that has long been associated with women's domestic responsibilities in the developing world (Rathgeber, 1996). Traditionally, women collected the water in the village by drawing buckets from public and traditional wells. With new technologies and changing livelihood opportunities for women, this has been changing over the years. In all but one of the villages (Daelan-Sobala), water collection from boreholes, modern wells, and traditional wells was also frequently done by children. Again, depending on the village, this included young boys in addition to the young girls who traditionally assisted their mothers with this activity.

With the boreholes in particular, more young children participated in household water collection. Increased participation is believed to be a result of the uniqueness of modern technologies, which are perceived as more appealing to the youth. Additionally, pumps are generally considered easier to use compared to drawing heavy buckets. As a result, all of the households interviewed in Ténéni indicated their children assist with water collection. The children often used bicycles to transport 20 L containers[7] from the pump to the household. A large proportion of young boys was observed collecting water during the data collection period. In fact, the relationship between children collecting water and the presence of older boys between age 7 and 14 in the household was significant (p=0.018). One councilman explained, "A *bidon* is a man's tool, thus it is not surprising men and boys now collect water." If a family owned a donkey and cart (*charette*), the children used it to fill and transport a larger number of water containers for their household. Younger women more concerned about keeping up with their daily household responsibilities than social *faux-pas* un-

[7]Used oil containers are called *bidons*.

der the eyes of more conservative elders, would also use bicycles to transport *bidons* if available in their households.

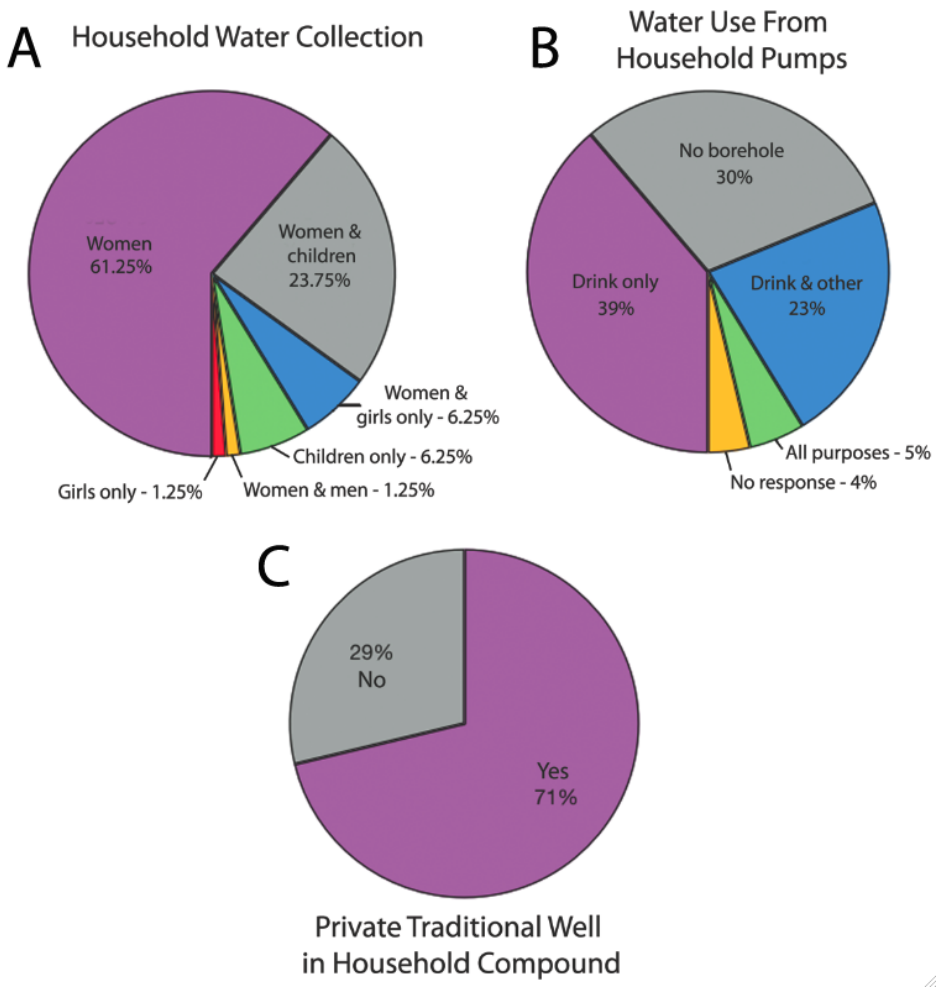


Figure 5.2: Water collection and use by households. A: Water collection in the household (n=80), B: Specified use of water from pumps by households with present or past access (n=60), C: Private traditional well in household compound (n=80)

Drinking water was collected twice daily: in the early morning between 05:00 and 08:00, and again during the early evening from 16:00 to 18:00 as meals were being prepared. Water use was generally very structured depending on the source. For instance, in a village like Somo where there are no boreholes, but a number of other water points available throughout the village, households

collected water from multiple sources depending on the intended use. Cooking and cleaning water often came from a public or older private household well. Drinking water, on the other hand, was collected from the newer household or garden wells. In villages with pump water, 39% of households said they collected water from the pump only for drinking (Figure 5.2 B). A small percentage (23%) of water users collected pump water for a combination of purposes (i.e., drinking and cooking, and occasionally for gardens), although it was not usually their sole source of household water. Only four respondents indicated they used the borehole for all household needs. In those cases, three of the four households did not have a private well and lived very close to a functional pump. When pumps were used primarily for drinking and cooking, traditional and public water was used for all other household activities. This exemplified the value in the improved water source perceived by most households. Sensitization efforts in the study villages had led to a general understanding that borehole water was a safe, secure source of potable water, even when borehole water may not actually be of good quality.

Most households had a private well in their compounds (Figure 5.2 C), although 29% of respondents used an outside source of water, such as a public or garden well, or collected water from a neighbor's private well. For those households residing in villages with nonfunctional pumps (n=20), alternative sources of water collection during pump disrepair included private household wells (45%), neighbors or extended family in village (35%), and garden wells (20%).

Of the 80 interviews completed with household water users, 41% used pumps regularly and 29% indicated they did not use borehole water because

of broken physical infrastructure (Figure 5.3 A). A quarter of the household respondents did not have a borehole in their village at the time of the study. Only two respondents indicated that although they had access to boreholes, they chose not to use the pumps. One individual felt the pump was too far from the household and the other, despite living in close proximity to a borehole (<50 m), preferred the better tasting pump across town, which was nonfunctional at the time of the interview. Of those who felt the pumps were located too far from their households (n=8), six participants resided more than 500 m from these water points. In villages with pumps, 38% of the households surveyed lived between 100 to 249 m from the nearest borehole (Figure 5.3 B).

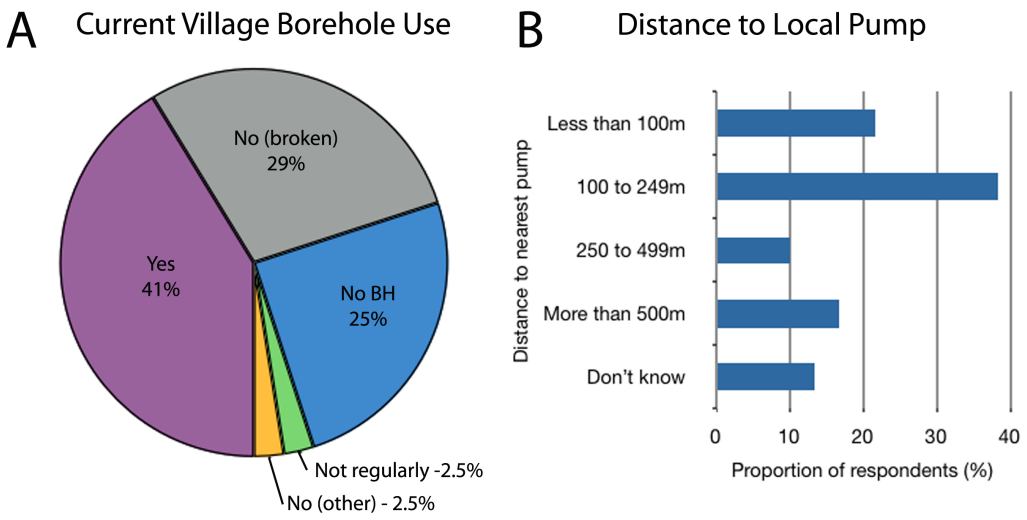


Figure 5.3: Current use and distance to local boreholes. A: Current use of boreholes in village (n=80) B: Distance to local pump in study villages (n=60)

Respondents stated that daily water collection took an average of one and a half hours from frequently used boreholes. The collection of drinking water often took two to three hours each day for residents living further away from boreholes. Whether a household had access to a functional borehole or not, however, the time required for water collection remained significant for

many water users. Location to the nearest well or pump, size of household, and number of water sources relative to the number of users must always be considered. A household with three members will not have the same water needs as a household with 10 or 20 members. In larger households, with multiple wives and/or daughter-in-laws, household responsibilities are shared, spreading the daily burdens of labor-intensive domestic chores such as water collection. Water collection usually coincided with cooking duties, therefore on each women's assigned day, she must collect drinking water for the household in addition to preparing meals. This responsibility is often rotated every one to two days among adult women in the household. Women of smaller households who cannot divide responsibilities may have had considerably less time for additional income-generating activities or participation in community events. The location of water points are not always central in the village, adding to the disparity between households. In many cases, boreholes were placed near the household compound belonging to the chief of the village or near other important social gathering points, such as the community mosque.

When asked who household water users felt was responsible for pump repair in the village, responses were mixed (Figure 5.4). One-quarter of respondents felt it was the sole responsibility to the village chief and council to ensure water infrastructure worked by whatever means possible, but without direct reliance on households. That said, nearly 28% believed it was the responsibility of the households to raise funds collectively for repairs. The sentiment was especially strong among households experiencing long periods of nonfunctional water infrastructure at the time of the study. This was an interesting finding since the overwhelming sense among local leadership, including communal government officials, village chiefs and council members, and WATSAN committee

members, was that households refused to pay for such repairs. The basis for these disconnects is discussed further in Chapter 7 (Community-based organization in water resource management).

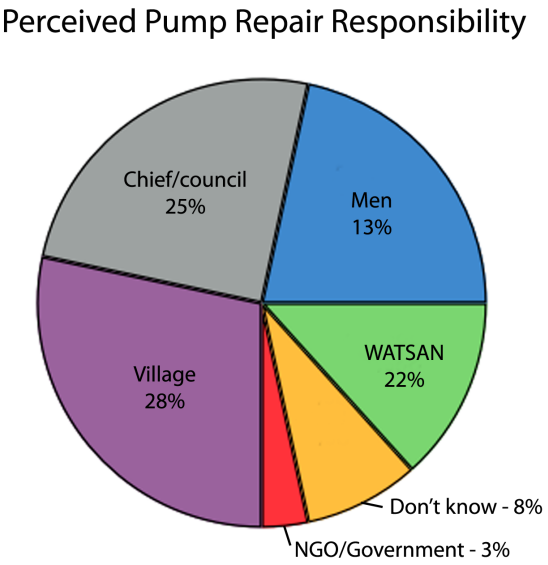


Figure 5.4: Perceived responsibility for pump repairs by household respondents (n=60)

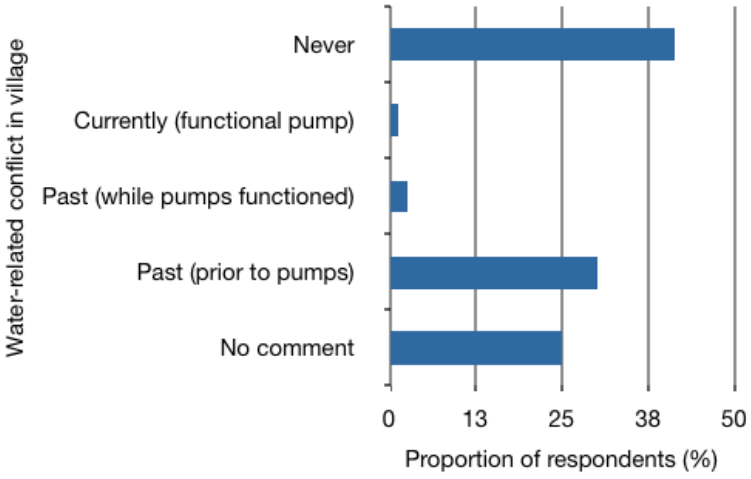


Figure 5.5: History of water-related conflict in village (n=80)

Most interview participants indicated water-related conflict was rare in their villages (Figure 5.5). This was not true for the residents of the villages who

had experienced more significant periods of drought. A total of 24 households noted significant conflict between women at traditional water points, particularly during the peak of the dry season following a year of limited rainfall. For these villages, conflict persisted until boreholes were drilled and more households started to construct private traditional wells. A small percentage (3.75%) of respondents also noted they had encountered conflict around pumps when women were forced to wait long periods for their turn to collect water. Those who acknowledged concerns regarding waiting times at boreholes did not view it at a conflict *per se*, but rather an annoyance. For the most part, these water users deemed the wait worthwhile for what seemed to be a safer source of drinking water. The alternative, using questionable well water with a history of causing stomach illnesses in the household, was much less desirable.

Although households contended with different degrees of access and quality within their communities, there were many commonalities with regards to preferred water use and collection. The findings with regards to pump reparation, however, suggested that greater combined efforts are required by WATSAN committees, external project partners, traditional leadership, and local governments to clearly agree on systems for infrastructure management (both physical infrastructure and the institutions supporting their operation). Additionally, these groups must make the decision-making process very clear to water users in the community. While regular sensitizations on the value of safe, sustainable water resources is important, households are ill-equipped to engage in the preservation of common resources like water without understanding the processes involved in their management.

However, actually participating in decision-making capacity was another is-

sue. In traditional village settings, most households do not have direct access to the process of collaborative water resource management. Even so, decisions regarding access to water supplies and maintenance of equipment, whether for household, agricultural, or fishing activities, impacted each individual in the study villages. As the discussion in Chapter 6 will highlight, their livelihood activities are dependent not only on sustainable water supplies, but also the sustainable use of numerous other local natural resources – which are all linked to the basic need for water.

5.6 Gendered roles in local resource management

Local natural resource use is highly gendered among households in rural Mali. Activities follow a seasonal routine for both men and women structured around the rainy season, which runs from June through September.[8] The following discussion examines seasonal, gendered-resource use in eight of the study villages.[9] Activity calendars showing gendered resource use and livelihood functions for households in each study village (excluding Pona) are provided in Appendix D.

Looking at water specifically, men were perceived as the resource guardians. Men were responsible for digging wells, providing the majority of funds for repairs to equipment, and seeking outside help to improve access to water. The heads of households were responsible for choosing the location of the private household well, although depending on the village, the head of the household

[8]The heaviest rains typically fall in July and August (Appendix F).

[9]Data excludes the village of Pona, where interviews were limited to the communal administration and the village chief and his council.

often needed final approval to dig from the village chief. However, this was more as customary etiquette than formal requirement. If a household wanted to build a well outside the compound, they had to seek approval from the village chief. Additionally, the village chief and council were responsible for determining the location of public water points, which according to some local leaders, was done after conferring with households in a community forum. In the case of borehole siting, decisions were made in consultation with technicians familiar with the hydrological conditions in the area. The technicians were contracted by the project financier to carry out the drilling in rural communities.

Women had control over how much water was used for each household activity and were responsible for most household activities pertaining to water use. The head woman of the household[10] was in charge of directing children and subservient women to collect water. Some men filled their own containers to take to the farm, if a borehole was located on their way to the fields. A significant amount of water was also collected by men to build and repair houses, a seasonal activity in rural villages (as shown by the activity calendars in Appendix D). Men made the decisions regarding water provision for livestock (oxen, horses, donkeys), while the young boys managed these herds. Women were responsible for the smaller animals in the household (goats, chickens, sheep), and sometimes directed their children to carry out the tasks of feeding and watering the animals. Although water collection varied slightly in each village depending on available sources, water for feeding animals was often collected from public traditional wells and at times, came from the same source used for human consumption.

Farming activities were also highly gendered and seasonal. Men and boys

[10]Generally the first wife, if more than one.

collected stalks from the previous season's fields between January and March for animal fodder. Manure and compost were collected and distributed on their fields during May and April. The men and boys started field preparations some time during June, using hand implements and oxen-powered ploughs. After land preparations were complete, the men sowed their crops. Upon the arrival of the rainy season, rice was also planted along streams and rivers in the floodplains and throughout ponded low-lying areas. Harvest typically started around September for the early crops such as maize, and continued through December for sorghum and millet.

Women also helped with many of the farming activities.Throughout the study area, women were seen working alongside men and young boys to help till the land, leading the oxen through the fields while the plough was driven behind them. Women worked collectively during harvest to raise funds for their women's associations in addition to assisting their households. Many women grew small groundnut crops independent of the main family plots for both household consumption and small trade. In 34% of the households involved in the survey, women held small plots of land aside from the main family holdings for these purposes (examined in more detail in Chapter 6). During the growing and harvest seasons, the days were very long for women who not only managed their usual household duties (collecting water, cooking, cleaning, and tending to children), but also contributed to farming activities. Young daughters provided a crucial support system for women, often assisting with water collection, tending to younger children, and cooking with their mothers. Women in households without daughters, co-wives, or daughter-in-laws clearly had tremendous workloads. It was not unusual to find young boys assisting, at least to a small degree, with some of these duties simply out of necessity. However, as soon as

a boy was old enough to assist his father in the fields, the household workload shifted once again back entirely to the women.

Outside the faming season, men and women partook in a number of independent activities. Men spent much of their time repairing or constructing homes and granaries. Women were responsible for additional activities, such as collecting firewood for fuel and gathering wild fruits for consumption and/or sale (e.g., mango, *karité*). In the San area, women were often given a *karité* (shea) tree by their husbands upon marriage. The fruit was collected between July and August to process into shea oil and butter – an activity carried out collectively by groups of women. These products were primarily used in the household for cooking, although small enterprise initiatives were growing and an increasing number of women's cooperatives were promoting the export of these shea products to urban centers, including Bamako.

Although there was a growing number of women's community gardens initiated by NGOs like WV, smallholder gardening also was practiced by both men and women throughout the region. Men tended to grow gardens beginning in January after the annual harvest was completed. They typically stopped in April or May when preparations began for rainy season farming. Women were far more likely to grow gardens year-round, although many said they could not keep up their gardens throughout the rainy season because of the increased labor demands for planting and harvest. Depending on the availability of water resources in the village, it was not unusual for households to stop gardening during the peak of the dry season until the rains had began and water levels were restored in the wells. In the study villages, the most common products grown in smallholder and community gardens included peppers, okra, onions,

tomatoes, and melons. From January through April or May, women also engaged in increased small trade, selling mostly the cereals grown by the household or vegetables from their gardens.

5.7 Closing comments

There are three valuable findings from this particular analysis, contributing to our understanding of historical and current water management practices in the *Cercle de San*, and the role of men and women in local water management in the context of development initiatives.

First, there has been a distinct change in water resource use among rural households in the *Cercle de San* since the onset of WAWI projects. Water collected for household use typically came from separate sources. When borehole water was available, the majority of households used this source for the collection of drinking water. Some households also used pumps to collect cooking water, but only a small fraction of households collected all of their domestic water from local boreholes. Regardless, pumps were always associated with drinking water. Water for other household purposes, including cooking, cleaning, laundry, and animals, was collected from either private household or public traditional wells. In villages without functioning pumps, water was also collected from preferred sources. For instance, newer garden wells were used for drinking water, whereas private household or public traditional wells were adequate for all other water uses.

Among the study villages with pump infrastructure, 70% of interviewees lived less than 500 m from borehole water. This suggests the decision to collect

water from a source of water perceived to be more safe than a household or public well is easy for these families, provided they have the household labor available to do so. For those living further away, the choice may be more difficult. A study by Boone et al. (2010) found that the choice of source for water users in Madagascar was very sensitive to distance. In urban areas, increasing the mean distance to a public tap by 1 km raised the probability of using a well near the household by 43%.[11]

The second core finding pertains to gendered resource management in the study villages. While it is not novel to learn that males and females participate in highly gendered household and community activities around locally available natural resources, it is interesting to think about these roles as opportunities in the context of development initiatives. This understanding stresses that traditional gender roles are extremely important and highly valued among rural households. The argument remains to include women in the various stages of planning and collective decision-making; there is a breadth of development literature advocating the inclusion of women in these processes to improve household security (Boserup, 2007; Kotzé, 2003) and to contribute to broader economic development (Benería, 2003). However, working with women and men separately on projects that impact their unique day-to-day responsibilities should not be considered non-participatory or exclusionary – rather, it is an opportunity to meet the short-term needs of diverse groups of individuals while building individual capacities for longer-term community development. Women often have heavy child care responsibilities, which strongly affects what tasks they can assume without compromising the health of their children. This is not an area that they can compromise. Community development will evolve

[11]The study could not evaluate this measure in rural areas because the number of tap systems available to households was too low for statistical analysis.

as individuals are empowered through improved health, access to education, and livelihood opportunities. The notion of gender equality cannot be forced among individuals who fundamentally do not understand it as such, that is, as a Western or Northern understanding of equality. Marginalized women (and men) have much to gain from increased opportunities to express ideas and experiences in non-threatening environments to build confidence and awareness (Meinzen-Dick & Zwarteveen, 2003). Using gendered approaches to rural development is about addressing power imbalances and devising transformative, adaptive strategies to accommodate gendered interests in participatory development (Cornwall, 2003).

Finally, and perhaps one of the most interesting findings in this study, was the prevalence of young boys assisting their mothers and sisters with water collection. This was most noticeable in communities with hand pump technology. Water collection has traditionally been the responsibility of women and young girls in Mali. Now, women and children (both males and females) collect water. The significance of this change is that young boys will take donkey carts or bicycles to collect water, which is much more efficient than taking single trips by foot with buckets. Also, it significantly reduces the amount of time women have traditionally dedicated to daily water collection. As newer technology in the villages, pumps appear to be more appealing to younger generations. This has the potential to significantly impact long-term development. Children are becoming actively engaged in the development process as water users. Young boys, who will one day manage households of their own in traditional villages, will have a greater appreciation for functional local water infrastructure and the preservation of potable water supplies for their families. Many young women already have this appreciation, however, women play a much different role in

local water management than men in their villages. Over time, these gendered roles and relationships will no doubt continue to evolve.

While both boys and girls are becoming more actively engaged in household water collection, it is important to reflect on the consequences increased water collection has on children's workloads and access to education. Studies have shown that the distance to a water source can directly impact the hours worked by children (Cockburn & Dostie, 2007; Akabayashi & Psacharopoulos, 1999). These two studies in Ethiopia and Tanzania found that as water collection time increases, so do the hours spent working, leading to a reduction of hours spent in schooling. While the research presented in this analysis does not suggest children are being pulled away from their studies to collect water in the *Cercle de San* study villages, it does stress the importance for NGOs and government agencies to consider the placement of improved water points to benefit children, as much as women, in rural communities.

The next chapter will examine household livelihoods more closely, including household security, perceptions of the roles in community water management, and the relative awareness and use of various technologies and practices contributing to improved community water resource management.

CHAPTER 6

RESULTS AND DISCUSSION: HOUSEHOLD DEMOGRAPHICS, RESOURCE MANAGEMENT, PARTICIPATION, AND TECHNOLOGY ADOPTION

6.1 Introduction

The following section summarizes data from household surveys in eight of the study villages. This analysis serves three important purposes: 1) to contextualize livelihood security among participating households by examining household structure and access to capital, 2) to determine how individuals define participation in local water resource management and how men and women perceive the level of this participation within their villages, and 3) to identify the relative awareness of various practices and technologies in water resource management and general rural development, including the sources of this knowledge and perceived skill. These areas of focus lend to later discussions on each of the initial research questions (see Chapter 1), adding context to the current state of village water resource management, experiences and perceptions in water development initiatives, and impacts of water projects on livelihoods and community natural resource use. The analysis highlights the different needs, expectations, and perceptions of water resource management between men and women in rural Mali.

The household (HH) demographics include a breakdown of the household size, age distributions, and access to education. More detailed information was collected from the individual survey participants including level of education, community labor contributions, and occupations. Data collected to determine

relative household stability in the area included animal possession, land holdings, and crop production. With respect to local water resource management, respondents were asked about the participation of members of their households in community meetings, as well as their awareness and use of various water resource technologies and innovations. Access to other development initiatives in each village was also evaluated.

6.2 General household demographics

The general demographics in the study villages identify the livelihood security of participants in part by examining available human capital within the household. Elements of human capital, such as education and access to income, are strong indicators of livelihood security (Lindenberg, 2002). Household structure, or more specifically the available labor pool, is also useful to contextualize the roles of women and men in local water resource management, and more generally, in rural development.

A total of 80 households were surveyed in eight villages in the *Cercle de San*. Of these households, the sample was split equally between male and female participants (Table 6.1). The average household consisted of 12 members, although it was common for one or two immediate relatives to move away and either live with another household (e.g., elder daughters) or migrate for employment (both young men and women).[1] Each household had about 11 members actu-

[1] A number of households presented a *Carnet de Famille* to aid in the identification of the age and sex of family members residing in the respondent's household. The *carnets* had been implemented by the *Ministre de l'Administration Territoriales et des Collectivités Locales* to create written household records. Previously, such records may not have existed for the majority of households in a region where family history is retained verbally through local griots and family elders.

ally residing in the compound at the time of the interviews, which included, on average, seven children each.[2] The largest proportion of household residents included individuals under the age of 15. Every individual interviewed noted at least one child (less than 15 years of age) in the household. The average age distributions of household members interviewed are shown in Table 6.2.

Household structure, as defined by the age distribution within households, offered a glimpse into women's support systems. Children between the ages of 7 and 14 played an important role by assisting with household labor (Figure 6.1). Girls often tended to the younger children, collected water, and assisted their mothers with a range of other domestic chores – learning the responsibilities they would one day manage for their own households. Sons assisted their fathers by tending to the livestock and working in the fields. In some villages, boys also contributed to water collection for the household, as was shown in Chapter 5. This was a rather new occurrence in rural villages and likely attributable to the presence of modern water collection technologies, specifically pumps.

Larger households with multiple women present operated on scheduled rotations for both water collection and meal preparation. This allowed women, particularly co-wives, to dedicate more time to supplemental activities outside of the household such as gardening and small trade. Nearly 49% of households were polygamous and over 41% of households had daughter-in-laws or wives of the head of the household's (HHH) brother living with the family (Figures 6.2 and 6.3).

[2]Children of the head of household residing in the household at the time of the survey, including children above the age of 15.

Table 6.1: Sample and household size

Survey respondent	Sample #	# in HH ($\bar{x}$± S.D.)	# residing in HH ($\bar{x}$± S.D.)	Age of respondent ($\bar{x}$± S.D.)	# children residing in HH*		
					$\bar{x}$± S.D.	max	min
Males	40	13.85 ± 12.4	10.98 ± 4.9	54.0 ± 12.9			
Females	40	11.35 ± 5.3	10.75 ± 4.9	42.7 ± 10.1	7.1 ± 3.6	19	1
Total	80	12.6 ± 9.5	10.9 ± 4.9	48.3 ± 12.9			

*children of the HHH of any age and all grandchildren residing in the HH (n=80 HH)

Table 6.2: Age disaggregation across households

# in HH < 15 yrs			# in HH 15–29 yrs			# in HH 30–59 yrs			# in HH ≥ 60 yrs		
$\bar{x}$± S.D.	max	min	$\bar{x}$± S.D.	max	min	$\bar{x}$± S.D.	max	min	$\bar{x}$± S.D.	max	min
4.9 ± 3.3	16	0	2.8 ± 2.1	11	0	2.5 ± 1.6	9	0	0.7 ± 0.7	2	0

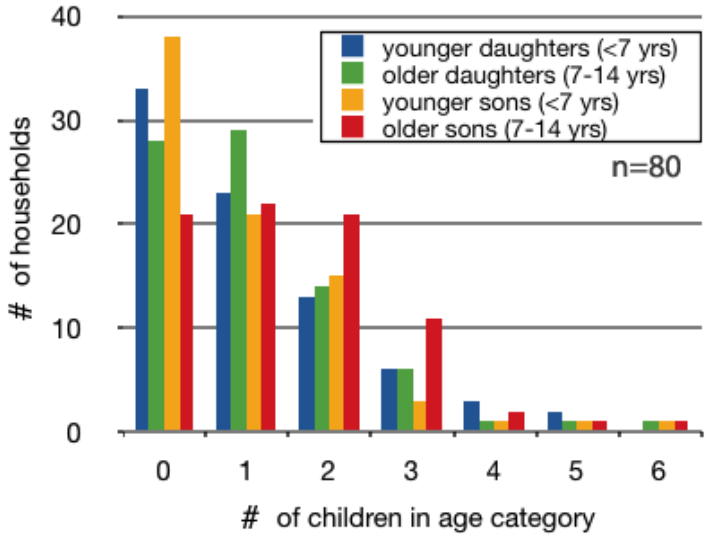


Figure 6.1: Distribution of children by age groupings

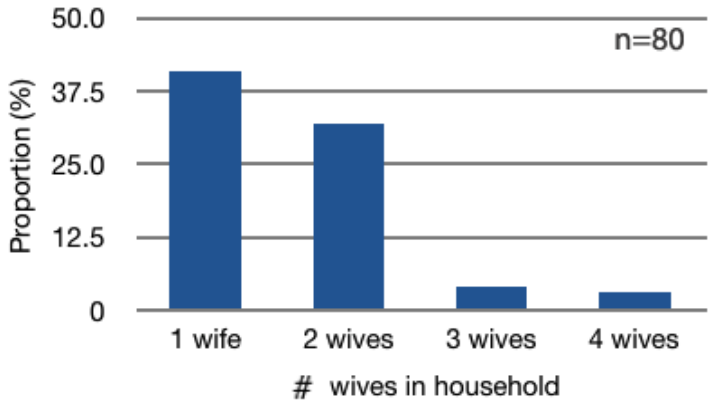


Figure 6.2: Number of wives in households

Daughter-in-laws living with their husband's family were always responsible for water collection. This was a daily duty regardless of the presence of other females, illustrating the hierarchy among women in the household. The prevalence of polygamous relationships in the survey area was indicative of the predominant religious affiliation of households (Figure 6.4). Islam was practiced in 85% of households, with 11.25% practicing traditional Animist beliefs, followed by a small representation of Christian households (3.75%). These de-

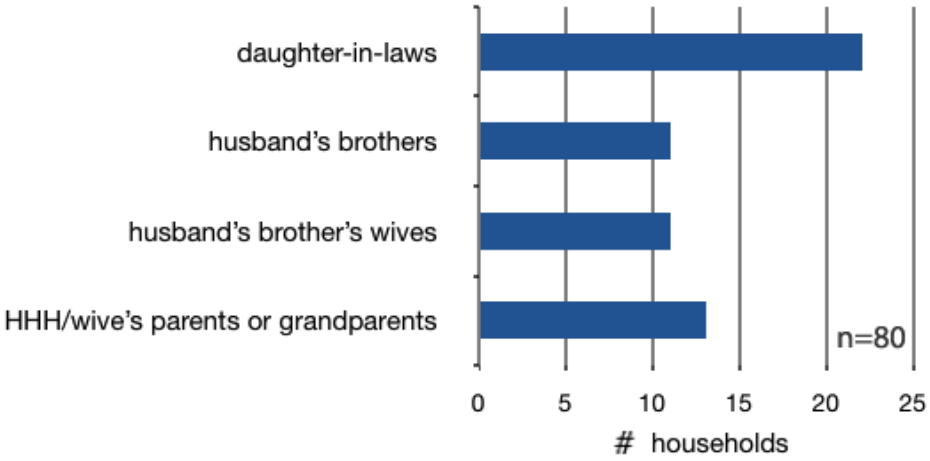


Figure 6.3: Extended family residing in households

mographics were in line with national statistics for the Ségou region available through the online database, Measure DHS STATcompiler (Macro, 2010).

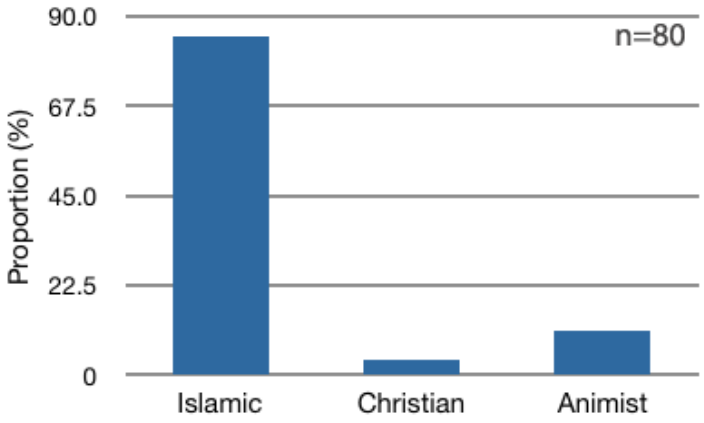


Figure 6.4: Primary religion in households

Access to education is an important issue for rural communities in Mali.[3] The Government of Mali has proposed a plan to provide access to and completion of primary education for all children between ages 7 and 12 by the year

[3]Education is a global priority in development, used as a common indicator of human well-being and security. The United Nations Human Development Reports use education as a measured component of the Human Development, Gender Inequality, and Multidimensional Poverty Indices (http://hdr.undp.org). Accessed November 10, 2010.

2015 (Mali, 2006). The government has also mandated the construction of additional schools to provide children with access to fundamental education within 5 km of their homes. However, as for many other basic social services in Mali, the government relies heavily on the international community to provide the capital and logistical resources to foster primary education. The national government plays a role formulating educational policy, while a growing number of international NGOs are building and staffing schools (Tounkara, 2001). As a result, there are an increasing number of community schools in Mali established with foreign assistance, yet managed by committees formed in the local communities (DeStefano, 2006). These private schools often referred to as community or development schools are supplementing the public system, which has not been meeting the needs of rural populations. The committees are responsible for hiring and paying teachers using the fees they collect from households and are also responsible for managing the day-to-day activities of the school.

Nonformal education is also an integral part of adult Malian schooling. Programs and facilities are often established by NGOs and community-based organizations. Instruction is provided either by NGO staff or community members and classes in reading, writing and basic accounting. Among the households interviewed, nonformal education (including nonformal, Arabic, and military) accounted for 40% of schooling among adult men and women. For children, however, nonformal education accounted for 24.5% of schooling for girls and only 14% for boys.

Among the households surveyed, approximately 50% of girls and 75% of boys had received some form of education, which is considerably higher than the national statistics (Macro, 2010). This was likely due to the fact that six out

of the eight study villages had been long-term partners of WV, which endorses a strong educational component through ADP development. These villages tended to have improved access to both formal and nonformal education for children and adults. Although access to education had improved for members of these households, it was not known whether these particular children would, at a minimum, complete Mali's first fundamental level of education (basic cycle 1, equivalent to grades 1 through 6 in North America).

In Mali, parents have been wary of the European curriculum provided by state-run schools because of a perceived threat to culture and social cohesion so highly valued in rural communities (Cavin, 2007; Trudell, 2007). Because of this skepticism, in addition to either not being able to or not willing to pay school fees and purchase uniforms, parents often choose to keep children at home. In the household, children assist with farming activities and tend to the household duties, the latter of which young girls tend to bear the greatest burden. This is generally the single largest barrier to the enrollment of young girls, however, more females are attending and succeeding in community schools than in past decades (DeStefano, 2006). This may be a sign of improving social acceptance to educate girls in a culture where females have traditionally been limited to their domestic roles.

Despite these promising trends regarding community schools, increased attendance, and the promotion of adult education, there are still significant challenges. Limited access to basic education remains due to imbedded social norms and resource constraints, widespread teacher and student strikes, and corruption in the education system. Harvard economist David Bloom argues that improving access to education is critical for countries to adapt to an increasingly

globalized world (Bloom, 2006). Additionally, the investment in education for women and girls has profound benefits for individual households, more than any other investment in human or physical capital (Summers, 1993). These benefits trickle upwards, strengthening the economic development, political stability, and social equality of communities and nations.

6.3 Participant demographics

The previous discussion highlighted a number of important indicators of livelihood security among households in the study villages including education, occupation, and household structure. The following analysis explores the characteristics of the interview participants more closely, adding insight to their individual roles within households and communities. The importance of community-based organizations (CBOs) is also introduced at this point, which in subsequent sections becomes a critical focus of the research. Examining CBOs clarifies decision-making responsibilities and opportunities in local water resource management among rural households. The differences between traditional CBOs and newly formed organizations in collaborative development projects is particularly important to identify opportunities for participation as well as the limitations, which ultimately impact water resource management.

All of the men interviewed in the water user surveys held head of the household status. This is important to note since heads of households have the opportunity to participate in community forums for decision-making (village assemblies) or are consulted directly by neighborhood leaders for their opinions on local issues. Of the women interviewed only one held this position – a recent

widow with a co-wife and nine children, six of whom were under the age of 15. In Mali, nearly nine in 10 households are male-headed (Macro, 2010).

6.3.1 Education

Among the survey participants, 60% of men had at least some form of education compared to 40% of women (Figure 6.5). In comparison to these particular female respondents, only 11 of the 39 (28%) co-wives in the households had at least some nonformal or formal education. Of the various forms of education attained by participants, men had attended primarily Arabic school[4] and non-formal school, whereas women attended non-formal and fundamental (basic first cycle), completing one or more years between grades 1 to 6. The educational background stratification was similar for the combined male respondents and 39 HHHs associated with the female interview participants.

6.3.2 Access to income

In the survey households, men typically cultivated land while managing a small herd of livestock (Figure 6.6). Male heads of households tended to have a wider range of secondary occupations than women, including animal breeding (listed under livestock), vegetable gardening, artisan/tailoring, building, and small trade (typically cereals). Women, on the other hand, described themselves

[4]Although Arabic may be taught during the basic second cycle as well as in private schools operated with funding from Arab nations, the type of Arabic education referred to in this study is that of Qur'anic schools. These are also considered a type of nonformal education but remain distinctly different than traditional nonformal education in that students are taught by a traditional *marabout* or religious leader. There is no state control or NGO partnership on the teachings and operations of these often controversial educational settings.

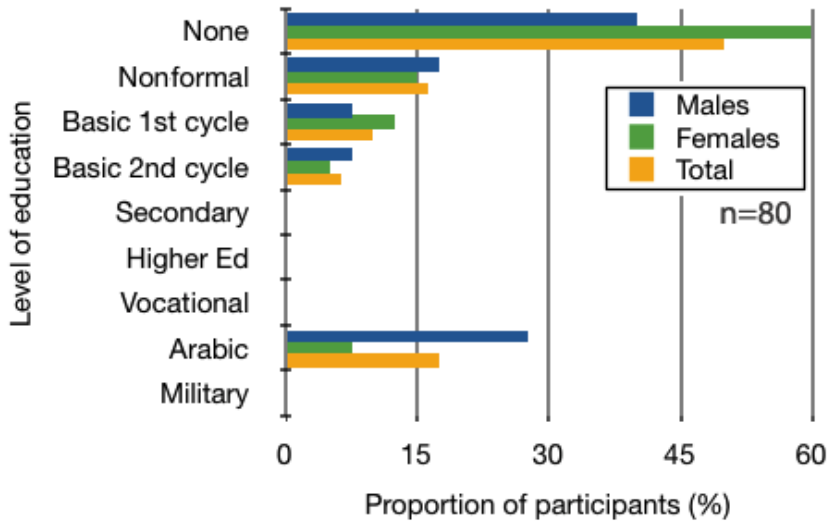


Figure 6.5: Education level of participants

as primarily unpaid household labor (Figure 6.7). Women also contributed to household income through vegetable gardening and small trade of these products, which in some of the study villages was an extremely important economic activity that had evolved with NGO assistance.

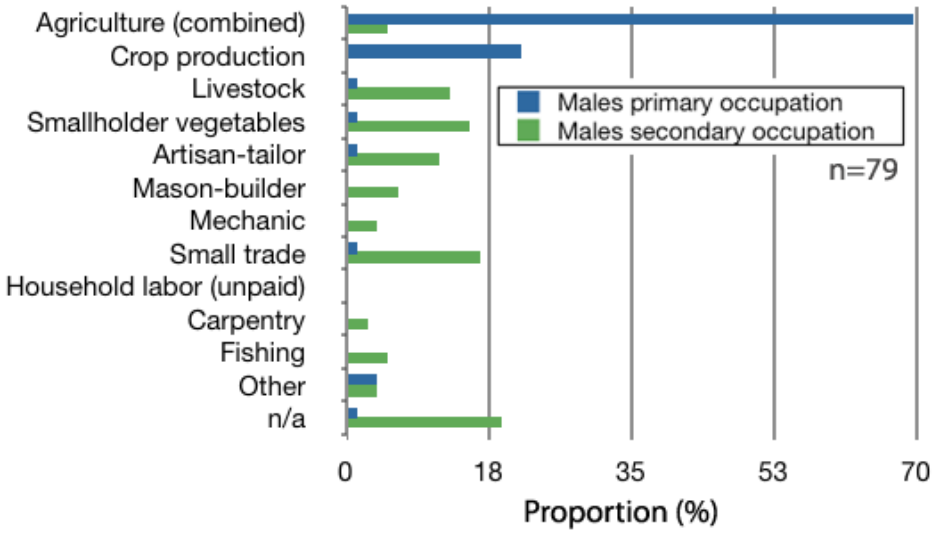


Figure 6.6: Male participant occupations

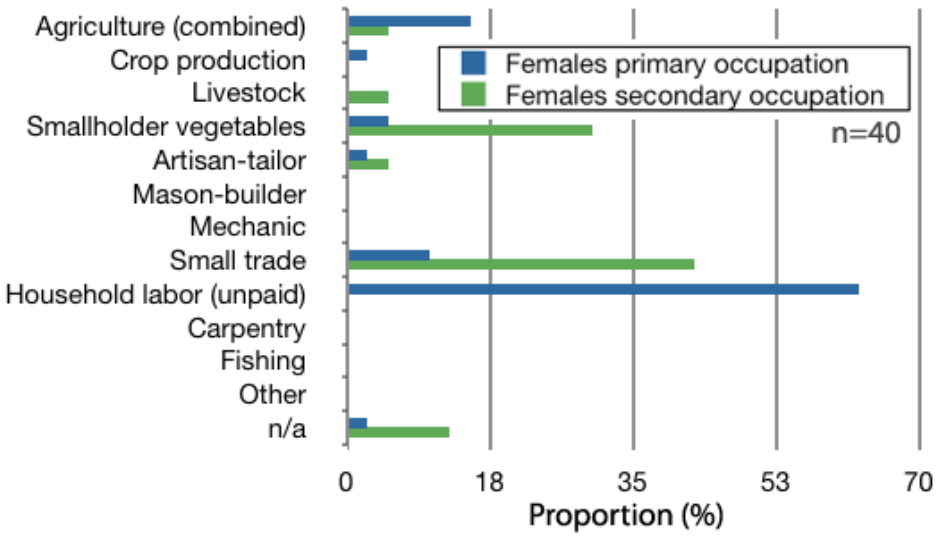


Figure 6.7: Female participant occupations

6.3.3 Community organization

As mentioned in Chapter 4, traditional CBOs are institutionalized in rural villages. Bambara communities, including those in the study, organize themselves around task-oriented working groups called *tóns* for a range of social and productive needs (Laugharn, 2007). Membership to *tóns* is very important within the village to work collectively towards the management of local resources and furthering community development. *Tóns* are particularly important to mobilize labor and financial contributions among households. Nearly everyone interviewed was a member of a traditional organization or newly formed committee in response to a development project (Figure 6.8).

Most men belonged to either a traditional men's organization (40%) or a *quartier* association (10%). The remaining proportion of men dedicated most of their volunteerism in community organization with a more focused association, such as a microcredit committee, agricultural cooperative, or school association.

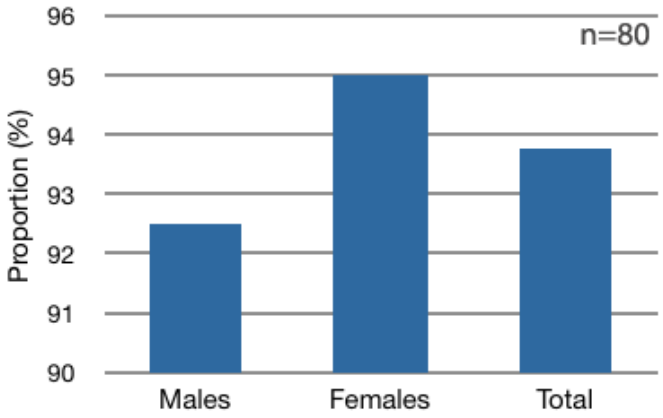


Figure 6.8: Membership held with a CBO

The majority of women interviewed belonged to a women's committee (62%), although a number of women reported primary membership with a garden (22%) or microcredit (8%) committee. The primary CBO memberships held by interview participants are shown in Figure 6.9. It was not uncommon for individuals to hold membership on multiple committees. This was certainly the case for individuals who had played leadership roles in specific committees (e.g., president). It was not unusual to find people with greater experience in committee management, also having enough schooling to allow them read and write, on two or three committees. The values shown in Figures 6.9 A and B represent how the interview participants most strongly associated their commitment to local organization by gender. This is not to say an individual valued a men's or women's association more than a school development committee, rather it illustrates the importance of CBOs in general, but for different purposes. While traditionally-rooted organizations have been legitimized by generations, perhaps their greatest strength is in promoting a sense of community unity. New, focused CBOs are also valued instruments to facilitate community development efforts, but they have limited legitimacy and authority in local

decision-making.

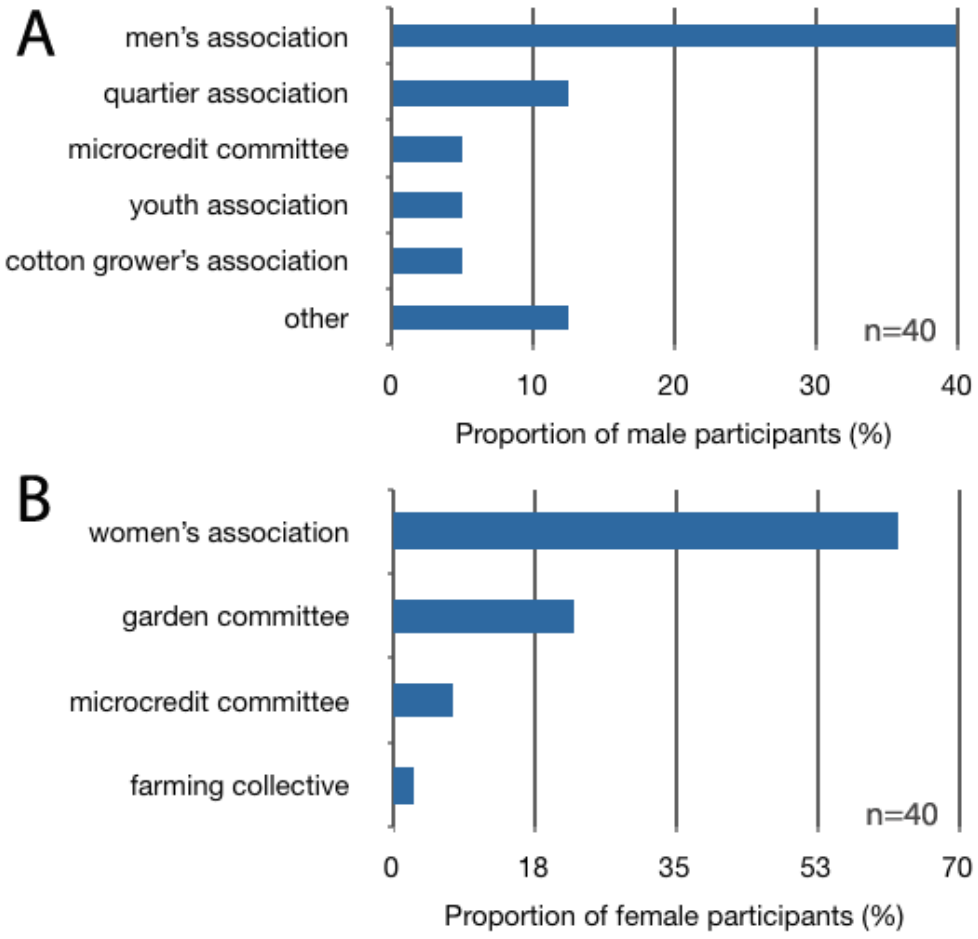


Figure 6.9: Most common CBO memberships by respondents

6.4 Agriculture and land use

Households in the *Cercle de San* depended on agricultural activities for subsistence. In this geographical setting, crop production and animal rearing were the two most important activities supporting basic livelihood security. Crop production provided a steady source of coarse grains to support subsistence farming households, and for some, provided products for local bartering and

sale within small, local markets. Smallholder animal (e.g., goats, sheep, and chickens) and livestock production, on the other hand, were the primary sources of household income that supplemented the agricultural products consumed by the family. This added income often covered incidental expenses for families, even if animal production was practiced on a small scale. Improved nutritional status was not perceived as an important driver for smallholder agricultural production among members of households interviewed. Smallholder gardening was also identified as a growing household agricultural activity in the study villages, providing households with additional food security, and income-generating opportunities. Improved nutritional status was another benefit of smallholder gardening, however, the nutritional benefits of vegetable consumption did not appear to be widely understood in the study villages.

Diversified smallholder farming households with at least some livestock ownership have greater income and food security than those reliant on cereal production (Kassa et al., 2002). Access to household agricultural activities, such as the management of small ruminants and plots of land, is particularly important for the empowerment of women in rural communities – having a direct positive impact on household well-being (Valdivia & Gilles, 2001). In Bangladesh, researchers found that smallholder gardens were an important household-level coping mechanism in environmentally and economically stressed regions for two significant reasons (Ali, 2005). First, the labor requirements for household gardens were most easily managed by women and children in the household, without displacing labor needs of men and older boys from larger-scale farming activities. Second, the crops selected could be adapted quickly based on local market and household consumption needs.

Crop production, animal rearing, and smallholder gardening are important sources of household income and food security in rural Mali, but none are possible without access to safe, sustainable sources of water to support rain-fed agriculture and household needs.

6.4.1 Crop production

In 1964, the Malian government established a grain marketing agency called the *Office Malien des Produits Agricoles* (OPAM) to provide markets for rural farmers, draw inexpensive cereals into booming urban centers, and to use agricultural surpluses to support other state investments (Dembélé & Staatz, 2000). The monopoly held by OPAM took a serious financial hit shortly after its inception through the 1970s during Mali's extended periods of droughts. In order to feed its population, the government had to import cereals and sell them at low prices, further deepening the deficit.

By 1981, structural adjustment programs implemented by the WB and IMF led to the liberalization of cereal trading in Mali. The *Programme de Réstructuration du Marché Céréalier* (PRMC) was formed, re-opening private trade of cereals across the country. The PRMC's support role in the agricultural sector led to increased competition and lower transaction costs for sellers, benefiting both producers and consumers (Dembélé & Staatz, 2000). Although numerous challenges in the grain industry continue, perhaps the greatest benefactors for the program have been food-insecure households in rural Mali, including those in the *Cercle de San*. During periods of hardship, households no longer have to wait for authorizations to purchase limited quantities of grains

though OPAM. While the *Région de Ségou* is one of the leading cereal producers in the country, many households still rely on much of their supplies just to feed their households. The U.S. Department of State (2010) reports that subsistence farming is practiced on 90% of Mali's cultivated land.

The average land area farmed by households in the study villages was 11 ha (± 8), although the majority of households farmed between 5 and 10 ha (Figure 6.10). Only two households borrowed or rented additional land beyond their permanent holdings. Of the households interviewed, 34% indicated the wife or co-wives farmed a separate piece of land averaging 0.8 ha. This land was often used to grow groundnuts or garden products such as okra, onions, tomatoes, and peppers. Two women also reported growing millet on their small plots of land.

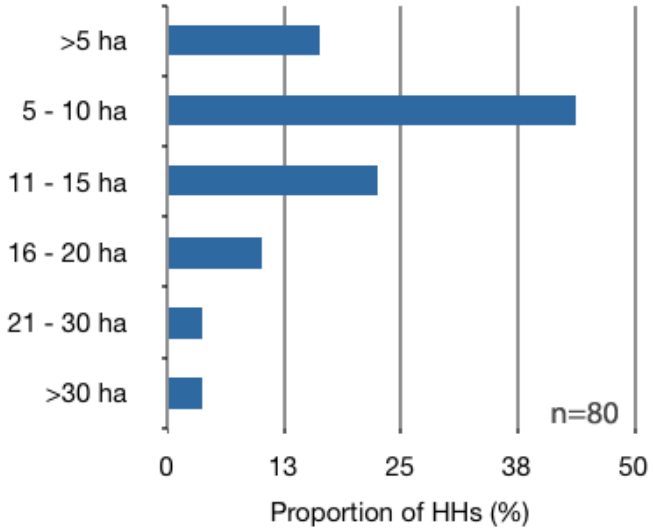


Figure 6.10: Total land holdings of participant households

On average, households farmed 3.4 parcels of land (± 1.8) ranging in size from a quarter to several hectares. Land is originally assigned to a family by the traditional chief. The land usually stays in the household from one generation

to the next, provided the family remains in the village or the chief does not reallocate the land at his discretion. On some occasions, land is borrowed between households or used on a temporary basis with the consent of the chief. Having *de jure* ownership of all land in the country, the Government of Mali does, at times, enforce its land and forest codes, such as the current land expansions for rice production by the *Office du Niger* (IRIN, 2009). During such occasions, the government assigns land for 'productive' purposes. For the most part, however, the government respects traditional land tenure in rural areas (Grigsby, 1996). Since the majority of land is provided by the village chief, households do not hold official titles for the parcels they farm unless they had received land through a government agent.

Although less common, some households accumulate land through marriage, whereby a wife's family presents the husband with a parcel. Alternatively, the new wife may already have a small parcel of land of her own, which may be shared with her husband after marriage. In Bambara culture, a married women does not have secure land ownership, even with her personal, small parcels of land. A married women's husband can take the land away from her or relocate her to a new, small parcel (Grigsby, 1996). This can have a negative impact on local land management as this lack of security often limits a woman's ability and desire to improve her land. Because of a woman's existing labor requirements in the household, additional land, whether a parcel for groundnut production or gardening, is a significant addition to her regular work load. These parcels are not easily maintained by all women, especially for those managing plots on their own. Some women are able to take on these additional activities to contribute to household income when there are co-wives to rotate work schedules, or daughters and daughter-in-laws who can be relegated the

household duties. The sale of groundnuts grown on these small plots, for instance, often went towards paying taxes, school fees, health expenses, and social events among households in the study villages.

The primary crops include a core group of cereals, and to a lesser extent, cash crop production (Figure 6.11). Cash crop production varies depending on geographical location. As an example, cotton production occurred in Diéli ADP but not in the study areas to the northeast. The primary crops among all households interviewed included sorghum, groundnuts, millet, rice, and maize.

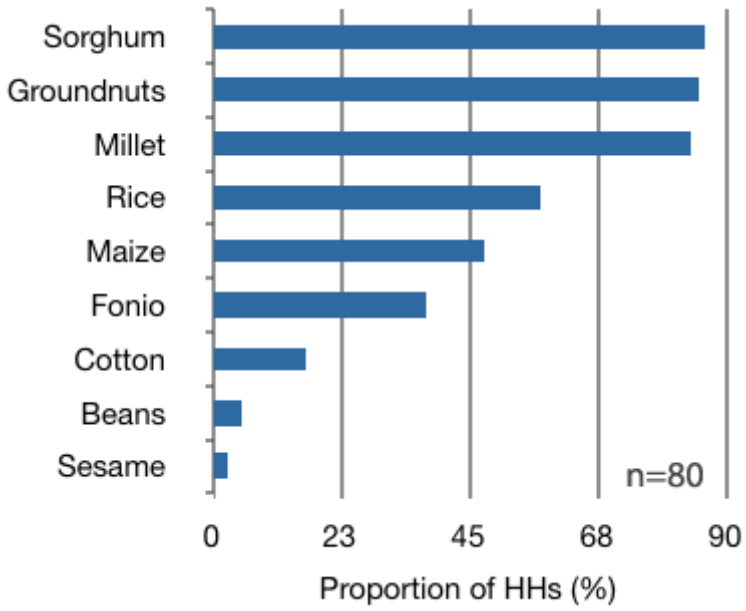


Figure 6.11: Crops grown by participant households

As discussed in Chapter 5 and shown by the activity calendars in Appendix D, activity during the rainy season was essential to rural livelihoods in the San area. During this period, everyone with the capacity to do so, contributes to seasonal agricultural activities including planting and growing. As the rains come to an end, the entire family participates in the harvest. Although most crops were saved for household consumption, some families benefited by selling or

trading a portion of their cereals.

Sorghum and millet were staple foods grown mostly for household consumption. Maize, which has a short growing season and is usually the first crop ready for harvest, offered families respite from the depleted food stocks as the hungry season ends and until staple crops were ready for harvest. It is worth noting here that crops like maize have higher water requirements than sorghum and millet (Critchley & Siegert, 1991), therefore there is a greater risk for extended food insecurity in regions with erratic rainfall, like south-central Mali. When maize crops fail and food stocks are depleted in the San area, the hungry season is extended until cereals can be harvested. Although most crops were grown for household consumption within the study villages, a few crops were sold for income. The majority of groundnuts were sold, although a portion was typically kept for use in sauces. Rice, which is grown in low-lying areas or along flooded riverbanks during the rainy season, was also kept primarily for household consumption (74% of respondents). A small number of the farmers interviewed (8.7%) reported selling most or all of their supplies for household income. Cotton was always sold since it is a cash crop grown on contract for the state-owned textile entity, *Compagnie Malienne pour le Développement des Textiles* (CDMT). The distribution of crop sales is shown in Figure 6.12. When asked if household participants felt as though crop production had changed over the past five years, the responses were mixed (Figure 6.13). A small number of interviewees indicated they were not able to sell certain crops from the previous growing season. Drought and flooding were given as the main causes (Table 6.3). Two households experienced serious illness of an immediate family member, reducing the previous year's crop production. As mentioned earlier, groundnuts were kept by a small number of households for the following year.

All crops were produced during the brief rainy season as limited rainfall in the area prevented expansive crop irrigation. Even the rice was grown solely during this time of year to take advantage of the swelling waterways.

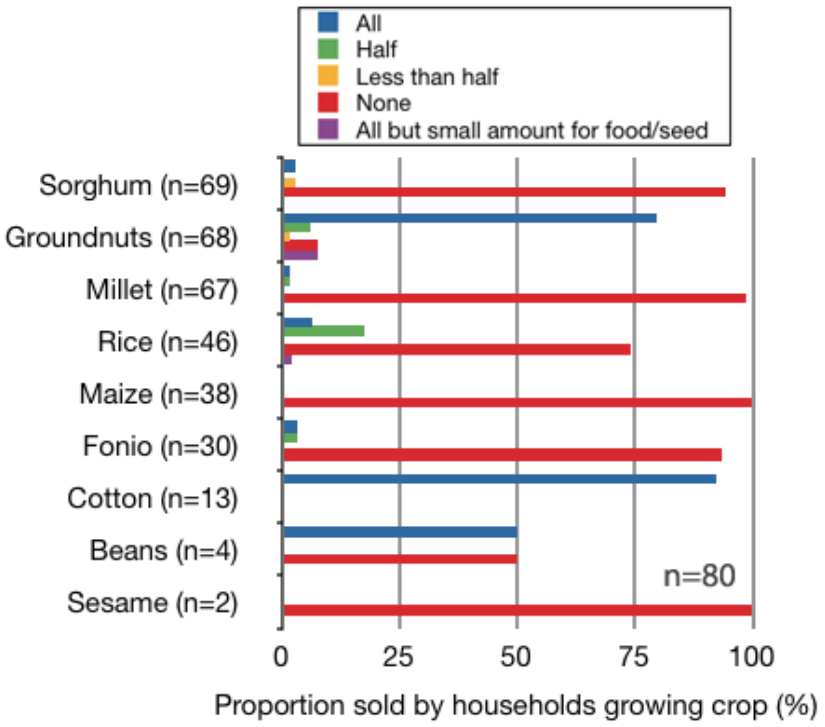


Figure 6.12: Sale of crops by proportion of households growing

Table 6.3: Primary reasons for poor crop sales among participant households (frequency of responses)

Crop	Drought/Flood	Illness	Keep Seed
Sorghum	3	0	0
Groundnuts	2	1	5
Millet	2	1	0
Rice	5	0	0
Maize	3	0	0
Fonio	0	0	0
Cotton	1	0	0
Beans	0	0	0
Sesame	0	0	0

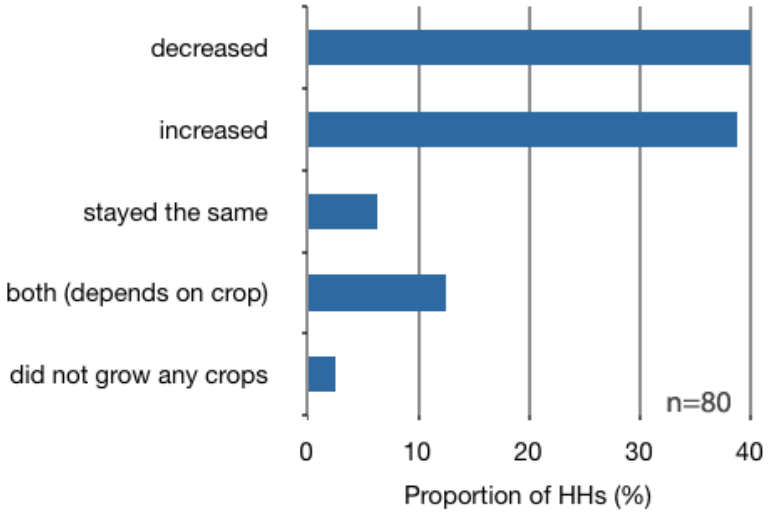


Figure 6.13: Perceived change in crop production over past 5 years

Manure was the primary input for all households, although 26% also used chemical fertilizer in the form of granular urea. Fertilizer was used by only 5% of households growing millet, sorghum, maize, and groundnuts, but 85% of cotton-growing households (n=13) purchased chemical fertilizer for this cash crop. Participants in cotton-growing households expressed the extreme challenges they faced as input requirements had increased over the years while profits decreased. According to these farmers, many farmers throughout the region with CMDT (*Compagnie Malienne pour le Développement des Textiles*, Mali's state cotton company) contracts had not even been paid for the previous year's harvest. Farmers had been accumulating significant debt as they continued their contracts with CMDT. During the time of the study, the highly indebted CDMT, which was partially owned by a French conglomerate and the Government of Mali, was in the process of privatizing (Hicks, 2008). It was unclear if the restructuring would improve or worsen conditions for farmers. In additiona to limited access to lucrative markets, Malian cotton farmers must compete with high subsidies in the United States and Europe, and the dumps of cotton in

global markets at low prices by these top-exporting nations.

6.4.2 Vegetable gardens

According to residents of the study villages, smallholder vegetable gardening was becoming more common throughout the *Cercle de San*, although it was not extensively practiced among all households. Villages like Bankouma-Bobo, claimed they had been growing small gardens for numerous years, after a community member learned about the practice while traveling. Other communities, such as Ténéni and Niamana-Masoumana, began gardening as a means to increase household food provision and small trade with assistance from WV and the establishment of community gardens. Of the 80 households surveyed, 55 (69%) said they practiced gardening very frequently. Only 18% of respondents said they did not garden at all. Most households said they became aware of the practice by observing other people (52%) and then learned how to garden directly from friends or family (34%). In most villages the activity was believed to be started by either other community members (39%) or through an NGO project (9%). Along with the establishment of community gardens, local NGOs have been raising awareness about the nutritional value and health benefits of vegetable consumption. Without access to larger regional markets, vegetables were not part of the regular diet until community and household gardens became more common practice in the region. In a multi-country study in sub-Saharan Africa, the World Health Organization found that poor vegetable consumption in rural areas (taking into account the costs to access markets) was attributed to the costs of production and prioritization among household decision makers (Ruel et al., 2004).

Efforts by NGOs like WV to incorporate smallholder gardens in community development programs had made it possible for many households to participate. The creation of community gardens, often specifically for women, provided designated plots of land for individuals. Hand-dug wells could be found in many of the community gardens, which provided sufficient water for the shared users. The garden plots and wells were managed by community garden committees organized by the NGO. While smallholder gardening generally increased the labor responsibilities of women, among all of the women interviewed, gardening was a highly valued source of household income and food security whether practiced in private compounds or community gardens.

The sizes of private and community garden parcels are shown in Figures 6.14 and 6.15. Private gardens tended to be larger than community plots and only a small proportion of households with private gardens maintained them within the household compound (27%). The larger private gardens were generally grown on small parcels of land at the edge of the village, sometimes on the way to the larger fields. For women who managed their own private plot in addition to the household's main holdings, a garden was usually planted on a portion of this land. The majority of interview participants with community garden plots indicated their households held two or more plots (78%). The size of a plot varied depending on the village, but a common community garden plot was measured as approximately 25 m^2. The large community gardens constructed by NGOs were generally one to two hectares in total area.

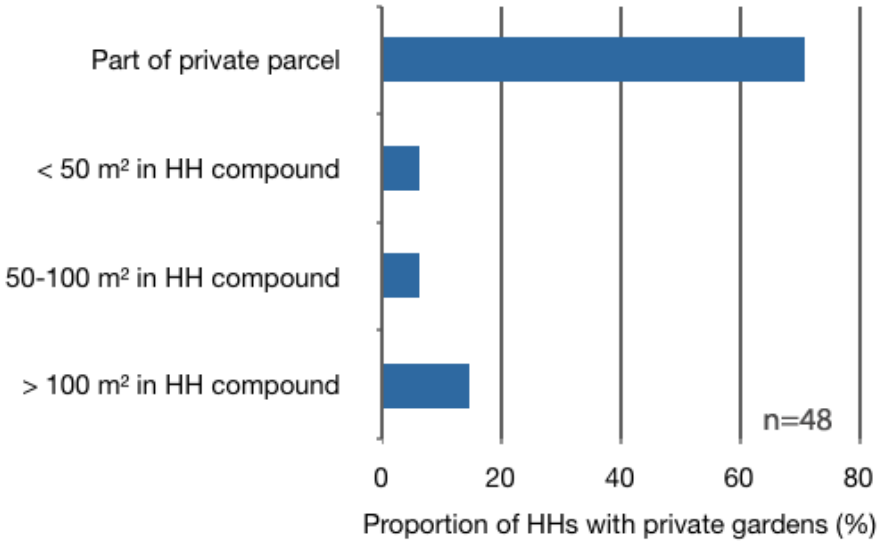


Figure 6.14: Size of private gardens in participant households

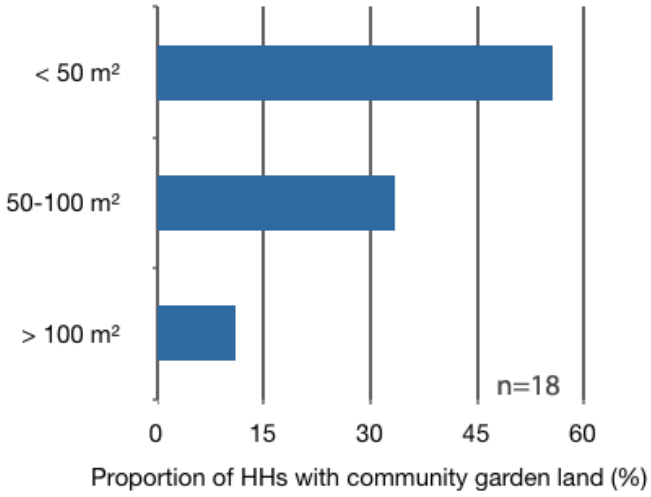


Figure 6.15: Size of community garden holdings by participant households

6.4.3 Livestock and smallholder animal rearing

Transhumant pastoralists, or seasonally migrating nomadic herdsmen, have been the purveyors of livestock production throughout the Sahel. However, the spread of cropped lands due to the intensification of agriculture and degrada-

tion of soils, along with changes in traditional waterways as a result of damming projects along the Niger River, are jeopardizing this livelihood throughout much of the region. Although significant periods of droughts and flooding have further challenged the livestock industry in West Africa, livestock remains an import export commodity in Mali, accounting for 44% of the nation's agricultural GDP (Kamuanga et al., 2008). As an adaptive strategy to cope with environmental conditions and market constraints, many pastoralists are beginning to diversify their farming systems. Many traditional pastoralists are now combining livestock management with crop production as herds are moved further south to compete for grasslands and water (Moritz et al., 2009). With this shift, the increased integration of traditional pastoralists and cultivators was believed to be a positive development in Mali, increasing available organic manure and access to animal traction during the planting season for many farming households. Although the occasional conflict arises between land users, farmers using increased organic manure have benefited from higher crop yields (Ramisch, 1998).

Among the primarily crop-producing households in the study area, the breeding and management of modest stocks of cattle and small ruminants provided an important supplemental source of income. Households used the sale of animals for a wide range of family needs. The prevalence of livestock and smallholder animal rearing suggested that this source of income was important for household security, perhaps just as much as supplemental off-farm income.

Most families within the study villages managed small stocks of livestock and small animals for local trade and household consumption. Among those individuals surveyed, most owned an oxen for plowing (92%), chickens (78%),

donkeys (71%), goats (71%), and sheep (64%). Half of respondents indicated their households also owned a horse for transport. Cattle rearing was uncommon among households participating in the study. Bambara households in the San area are known for crop production whereas other cultural groups, such as the Fulani, are known for cattle herding. Very few participating households kept animals on behalf of family or friends. In these instances, mostly goats (9%) and horses (5%) were being kept. The proportions of households in the study owning and keeping animals for others are shown in Figure 6.16.

Half of the respondents indicated that animal rearing within their households had reduced over the past five years, primarily because of animal deaths due to disease. About 36% of survey respondents reported an increase due to successful births and improved household incomes, allowing for the purchase of additional animals. Less than 5% reported that animal holdings remained relatively the same over the past five years. The *Service Agricole de San* reported steady increases of animal holdings for each of the villages in the study over the past 10 years (Appendix G). This could be explained because those with herds that were increasing added more animals than those whose herds were contracting. The discrepancy between recorded and interview recounts of animal populations may also suggest that annual government records were more of an estimate, rather than a complete census of animal holdings. These government records were based on vaccinations obtained by local farming households through the *Service Agricole*.

The decision to vaccinate animals was typically made by men. The family's religious background influenced this decision, just as much as economic capacity of the household. Some animist households were superstitious of modern

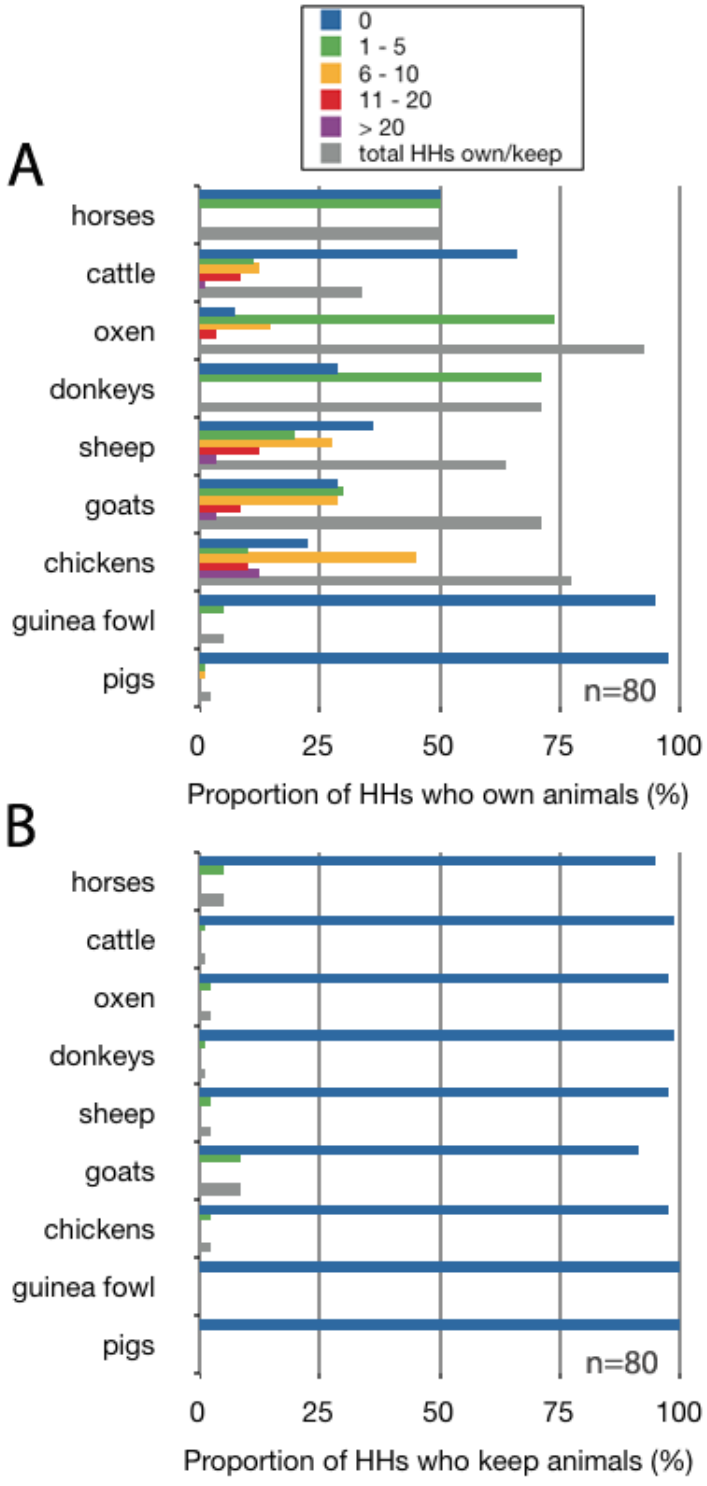


Figure 6.16: Animals managed by participant households

veterinary medicine, believing that vaccinations were harmful to their animals. This has had detrimental effects on smallholder animal rearing in many villages. The loss of free-ranging animal populations was common among households, especially among those raising chickens. Chickens can quickly transfer their illnesses to one another, destroying entire flocks.

Animal ownership and management responsibilities were slightly gendered. Men owned all large livestock (e.g., cattle, oxen, horses, and donkeys), which were generally taken care of by boys. Women were more likely to own or manage smaller animals such as goats, sheep, and chickens and often ordered their children to water or feed them each day. Out of respect, women were expected to ask their husbands for permission to sell animals, although this was mostly seen as a formality. The ownership of small animals by women was viewed as a means to elevate their independence and status within the household (Kolff & Wilson, 1985). While this may be true for many women throughout West Africa, it may also be more of a practical animal management strategy. Given the division of labor in the household in rural Mali, women filled an important household labor need as men and older boys were drawn away from the household during the day for fieldwork, mud construction, and managing traction livestock.

Animal rearing was an important household activity in the study areas. To explore the role of animal rearing in household livelihood security, participants were asked to rate by order of importance the use or sale of livestock and smallholder animals for a range of purposes. Eight of these purposes deemed relevant by survey participants are shown in Figure 6.17. The sale of animals or animal products provided a core source of household income (A). The payment

of school fees (C) and the costs of social or cultural events (E), followed by providing funds to cover family health expenses (D), were extremely important benefits of animal rearing. The animals also provided organic manure for crop production (G), which was a highly valuable, inexpensive, and accessible source of fertilizer among households surveyed. Animal production factored as less of a priority for household security (B), as a source of food/nutrition (F), and to pay taxes (H).

6.5 Participation in local water resource management

The households were asked how they defined participation in local water resource management, and to describe perceived participation. The results are illustrated in Figures 6.18 and 6.19.

Men and women defined participation in local water resource management differently from one another (Figure 6.18 A). Men stated both membership on a related committee as well as speaking at community meetings were important to participation (48%). Women, on the other hand, felt as though either attending community meetings regarding water management (35%) or holding membership on a related committee (28%) sufficiently defined participation. Attendance at community meetings (Figure 6.18 B) was perceived to be slightly higher for male respondents (60%), compared to women (52%).

Most men and women rated themselves and members of their households as having excellent participation in water resource management (>80%), although men perceived their participation as slightly higher (Figure 6.19 A). Women were somewhat more critical of their household's overall participation in local

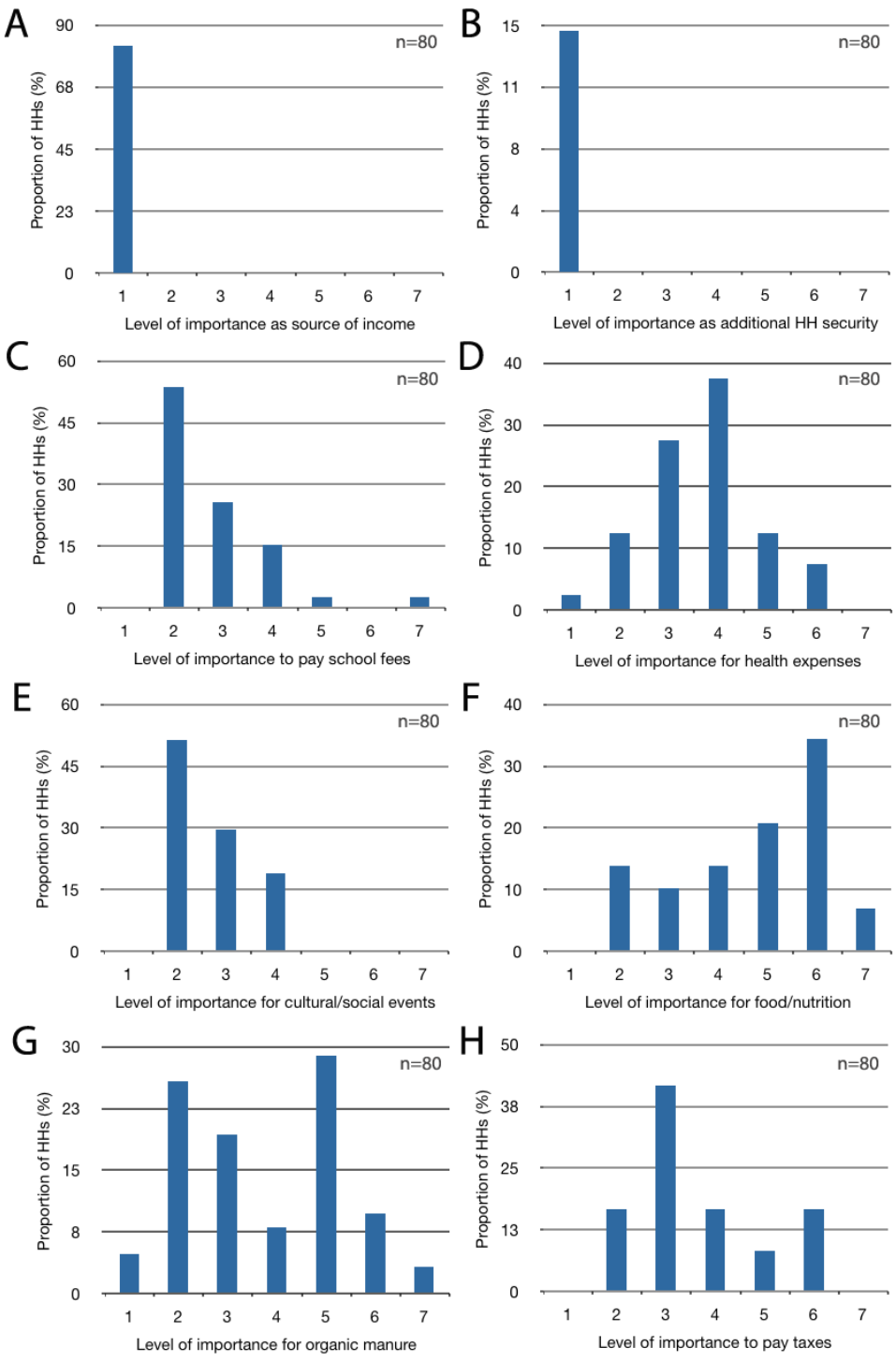


Figure 6.17: Importance of animals for households

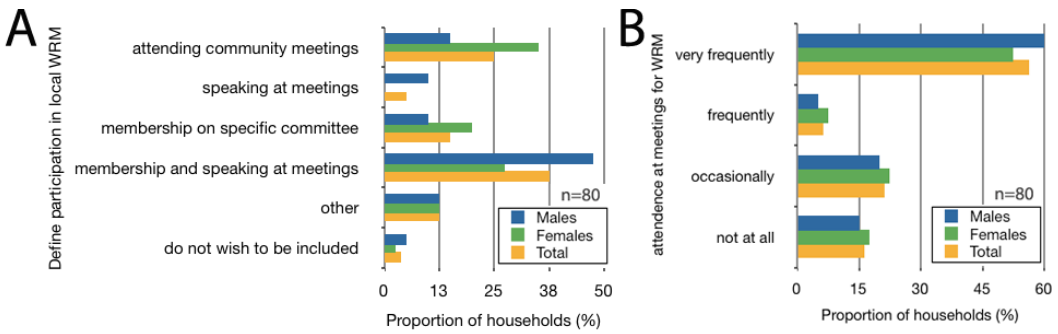


Figure 6.18: Defined participation (A) and meeting attendance (B) by households

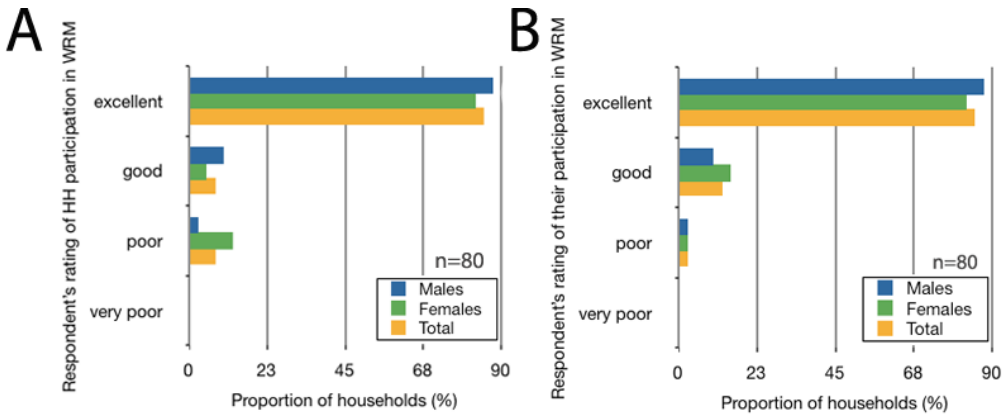


Figure 6.19: Perceived household (A) and personal (B) participation in community WRM

water resource management, with 12% describing their participation as poor (Figure 6.19 B).

6.6 Knowledge and use of technologies and innovations

Interviewees were asked to describe their relative knowledge and use of a variety of water management practices and technologies using a categorical scale. First, participants were asked how frequently they used the practice or

technology, and how they rated their level of skill in this use. Individuals were then asked to rate their level of knowledge or understanding of the design and purpose of the practice or innovation. Both the source of the knowledge (how they became aware of it) and the source of skill (who taught them to apply the practice or technology) were identified. If the practice or technology was being used in the village, participants were asked who originally started it.

Two community development activities, microcredit and cereal banks, were also included in the analysis based on their prevalence in the study area. These practices were included in the survey to gage gendered differences in knowledge and skill of non-water-related initiatives. While this analysis offered insights to general community development, the scope was limited because these two particular development activities are already inherently gendered. Until recently, agricultural development projects have targeted men because they were perceived as the primary producers for the household despite much evidence to the contrary, particularly in Africa. In fact, women participate in at least 50 to 80% of agricultural work in Africa (Boserup, 2007). But the focus on men in early development efforts may also be attributed to the androcentric nature of land tenure as a result of traditional systems of kinship (Gray & Kevane, 1999). While land tenure remains male dominated to the detriment of countless women in the developing world, the inclusion of women in agricultural development projects has improved. Women are being recognized for their labor contributions, traditional knowledge, and for their largely overlooked role as food producers in both rural and urban settings (Pimbert, 2009).

In the case of cereal banks in south-central Mali, however, men were almost exclusively observed as the key participants in these particular development

initiatives. Microcredit projects, on the other hand, are more frequently implemented to empower impoverished women and are a positive investment for rural development. Women are shown to save more, default less, and invest more in child and household well-being than men (Mayoux & Hartl, 2009).

6.6.1 Water resource management practices

Participation in local resource management is considered to be a central component of community planning and development. Participatory processes have been encouraged and successfully implemented as a water resource management strategy throughout the developing world (WB, 2003), especially to promote the inclusion of marginalized populations such as women (UNDESA & GWTF, 2005). Further, water management and sanitation projects are shown to be more successful and sustainable when women actively participate in the planning and implementation stages, than projects that exclude women (Van Wijk-Sijbesma, 1998).

Most household members surveyed recounted learning how to use certain technologies or practices by their own observation and experimentation (Appendix H, Figures H.1 to H.16). Some technologies, such as hand dug wells, have existed in these villages for hundreds of years. As a result, skill of use is second nature to everyone in the village. Since the construction of traditional wells is considered hard labor, they are believed to be a man's responsibility.[5] It was not surprising that men's level of knowledge was perceived to be higher

[5]When men were asked what was considered hard labor, they discussed farming and building houses, activities considered to be in a man's domain. Further probing indicated they did not instinctively associate the collection of water or firewood, which are physically demanding tasks and happen to be the responsibility of women, as hard labor.

than that of women for such a practice.

Survey participants indicated a high level of competency in a number of water resource management practices, particularly with protected wells, modern wells, and foot and hand pumps. Even if individuals did not have foot or hand pumps in their village, many had seen and used them elsewhere. Most participants associated these more recent technologies with NGOs, government or at the very least, a formal project that brought the infrastructure to their village. The more detailed data for hand pumps are provided in Figure H.5 (Appendix H) to demonstrate these findings. Results for the 12 additional practices and technologies explored are provided in Appendix H.

For protected wells, the competency of use was considered high among men and women, but the level of knowledge or understanding was much lower. Households understood how to cover and protect their traditional wells, but not everyone understood the purpose behind it other than to keep large debris and children from falling into the well. And although households indicated they protected wells regularly, it was rarely observed in the field. In fact, it was more common to find a woman filtering water than it was to find a protected traditional well. Filtering water was reportedly practiced very frequently by 86% of households, while even more individuals reported protecting their wells (94%). However, less than a dozen household wells were observed to be protected among the study households during field research. It was possible households had a highly variable understanding of the practice of protecting wells, or that most of the household wells were simply observed while in use and without their cover or protective barrier. This discrepancy may also be explained by the challenges in teaching households about the specific health benefits of such

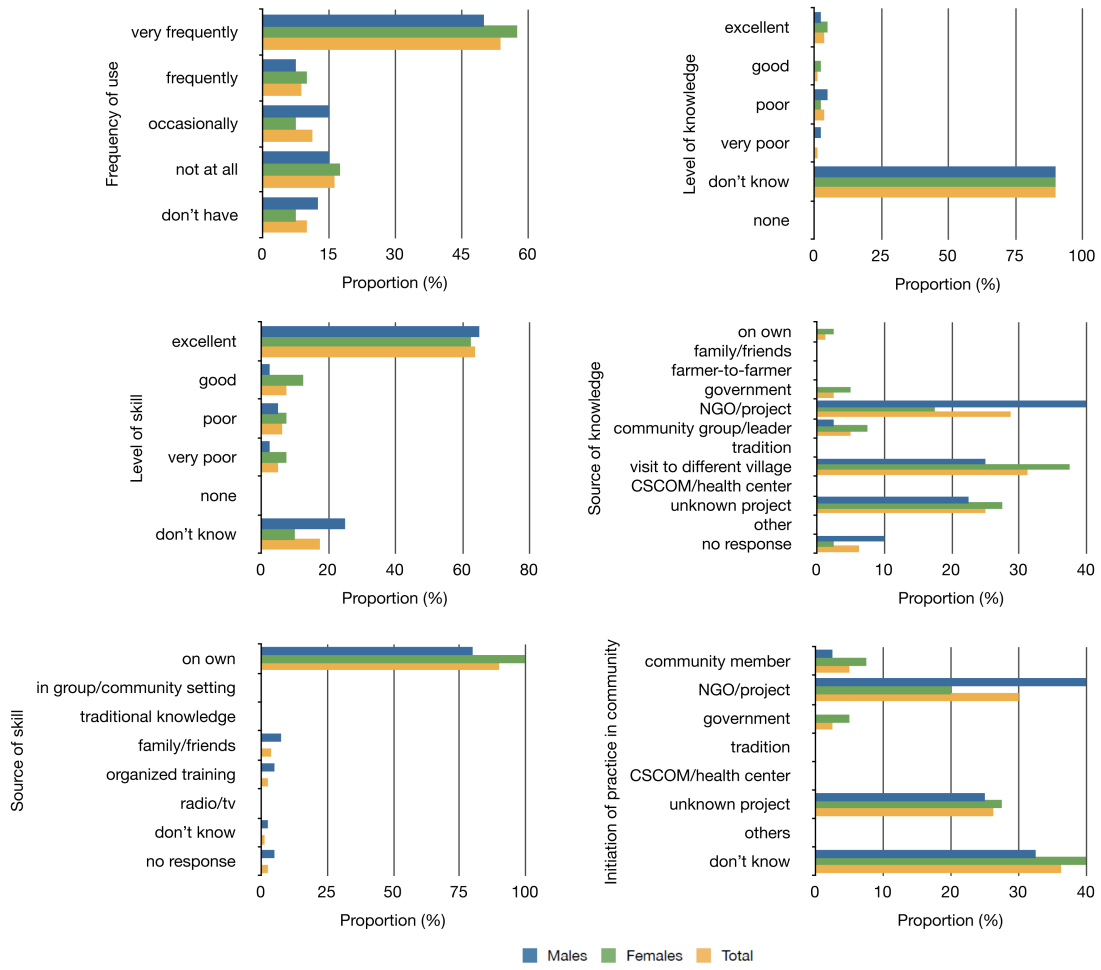


Figure 6.20: Water resource management practices – Hand pump

practices and the fine line between social learning and actual behavior change.

The concepts of microorganisms and bacteria are not easily understood because of a lack of education, particularly among adults who are managing these resource management tasks for the household. In other words, what someone does not see will not hurt them. Therefore, the approaches to teach improved water management practices must be appropriate. The concept of disinfecting water was somewhat different because of the high frequency of sensitizations conducted by the community health center (CSCOM), health volunteers, and

NGOs. Health-related announcements were also made from time to time on the newly established Téné radio station. Households had been sensitized so prolifically by these sources, they instinctively associated certain technologies, such as boreholes, with 'clean' or 'safe' water. But it appeared to be personal trial and error that created the behavior change. Once an individual realized a certain practice effectively reduced or eliminated a discomfort or hardship (i.e., stomach aches or medical expenses), that practice or technology seemed more likely to be adopted.

In any case, health centers and NGOs have played an important role in providing training for certain water management techniques, including filtering and disinfecting drinking water collected from wells. More individuals learned to filter water through family/friends and visits to other villages (50% of respondents), but adding bleach to drinking water was often taught through organized trainings by the local CSCOMs (25% of respondents). Only one survey participant (out of 80 surveys) practiced the disinfection of household wells, although some individuals recalled the local CSCOM providing training on the topic. For the most part, people did not feel comfortable or knowledgeable about the procedure. Besides, the added cost to purchase bleach for the household wells and drinking water was deemed significant enough for households to make this practice less of a priority. Many households felt as though the removal of visible contaminants through filtering made a significant difference. However, some individuals said they could see small organisms swimming in the water. Many indicated that if they could afford the bleach, they would take better care to treat potable water for their families. People recognized that adding bleach to drinking water supplies was an appropriate practice as conveyed to them through health sensitizations from representatives of NGOs and

local health centers. However, it was unclear whether cost was the prohibitive factor or if the underlying problem was that household decision-makers did not recognize the value of the practice.

The mobility of individuals in households was an important component of community development. By visiting larger centers or observing various development projects in neighboring villages, households became acutely aware of their relative degree of development – in particular, the property one village had that another did not. It is through this process that households expressed their awareness and skill using a wide range of innovations they did not have in their own communities. This included modern wells, treadle pumps, solar pumps, water towers and tap systems, and drip irrigation. River protection and drainage ditches were also well understood by a number of men and women. Some of these individuals (14%) had worked as hired labor with various land development programs to improve regional agricultural productivity, including the *Office du Niger* in Niono and the local *Plaine de San*. Others learned about these practices while living abroad in neighboring Burkina Faso and Côte d'Ivoire, or while visiting more urban centers throughout Mali. Some households applied what they learned while working outside the village by using drainage ditches to divert water from their households and maximizing water use in their fields during the rainy season.

One management practice that was neither understood nor used by any of the study households was roof catchment. Collecting and storing rainwater (rainwater harvesting) for household and gardening purposes seemed a technology with considerable potential for the region, and at the time of the study, it was completely underutilized.

6.6.2 Additional community practices

The two most common development initiatives identified in the study area outside of water resource management, included microcredit and cereal banks. Men tended to describe themselves as more knowledgeable than women about these practices, which was not surprising since men were found to have more education than women among the study households. However, 40% of women used microcredit resources in their communities compared to 22% of men. Through organized trainings or community meetings, households recalled learning this skill from government or NGOs. Often a household was unable to recall the exact source, but recalled learning through some sort of formal project. These projects could be identified as either government programs or NGO initiatives depending on the village (Chapter 4), according interviews conducted with local administrators and NGOs in the area.

A smaller proportion of survey respondents had used cereal banks. Those who had were mostly men (18%). Again, the government and NGOs were a source of knowledge and training for individuals. The complete findings for these two practices are provided in Appendix I (Figures I.1 and I.2).

6.7 Closing comments

The details of this chapter served three purposes: 1) to examine relative household security in the study villages, 2) to explore perceptions of participation in local water resource management, and 3) to identify the awareness and applied knowledge of various water resource management and development

innovations.

Looking at relative livelihood security, most households had a substantial number of family members depending on a shared agricultural subsistence. Household structure influenced the roles individuals played when carrying out household activities, which were mostly determined by gender. These roles may be altered temporarily in situations of labor constraints (i.e., young boys assisting with women's responsibilities) or roles may be shifted because of labor surpluses (i.e., seniority among multiple adult women). Each of these roles were closely tied to local natural resources, which support extended families living together in a broader community setting under the authority of traditional village leadership. Besides basic survival needs, nearly all household income-generating activities depended on access to water. Crop production, livestock and small animal rearing, and smallholder gardening were only possible with sufficient seasonal rains and year-round water availability in local wells and boreholes.

Local decision-making regarding water resource management was practiced in a community forum, although men and women defined their participation differently in this process. Men perceived their role as active, both by attending local meetings and verbalizing opinions. Women, on the other hand, perceived their roles as more passive and appeared to be less likely to vocalize their opinions in a public setting. That does not mean that women did not adopt practices learned during community forums, nor that they did not have a voice within their households. This particular analysis focused only on the direct participation of men and women in community meetings where issues of local water management was discussed. Other forms of participation are expressed at the

household level, especially through the adoption of practices to improve water management. Ultimately, final decisions regarding local natural resource management and community development outside of the household fell in the hands of the village chief and council. The traditional leadership of the village chief and council is a highly honored system of governance among the Bambara.

Adults in the *Cercle de San* travelled frequently for regional trade, employment opportunities, and to visit relatives. The extensive awareness of water management practices and technologies was illustrated by the mobility of household members. During these travels, members of a household gained knowledge of initiatives and practices that were leading to improved resource management and village development. For some communities, the growing awareness of opportunities translated into working collectively towards village development. This particular analysis was useful to identify some of the underutilized and poorly understood water management techniques in the region (e.g., rainwater harvesting or roof catchment), and to encourage the use of various practices that had been learned in other villages, but have not been applied in their current environments (e.g., drainage ditches). The presence of a wide range of government agencies and NGOs had also provided both men and women with technical training in community development efforts such as cereal banks and microcredit. In some of the study villages, these externally-organized activities appeared to contribute to the local development, especially in the case of microcredit (e.g., Ténéni, Somo, Tiomporosso, Paparoné). There was a great deal of enthusiasm for projects that were designed to improve local agricultural activities, such as cereal banks, although only a small proportion of households have had an opportunity to use the practice and participation has been male-dominated.

An important point regarding the introduction of new technologies and practices for development and local resource management was made in Paparoné, where community members generally had the least interaction with aid agencies and government development programs. Members of households and community leaders stressed repeatedly that while outside partners had much to offer the village, in terms of resources and expertise, the community had specific development goals. The community expected these goals would come into conflict with projects offered through external assistance. For instance, while a foreign visitor to the village would assume the need for boreholes given the lack of pumps in the community, the households saw improving the water system as a longer-term goal. Year-round water availability in protected public wells and private household wells had made water provision less of a priority than other village needs, such as improving education for their children. Education was a more immediate goal of the community. Water was considered a well-managed resource out of necessity in the village, but limited capital had prevented implementation of other development opportunities. The future challenge is ensuring external partners are more receptive to the needs of the community, rather than simply imposing technologies and practices that are most comfortably implemented by the partner.

Now that the analysis has examined some of the key stakeholders in water management including the government and partner NGOs, and most importantly, households, the following chapter takes a closer look at a key component of community development partnerships in water management – the local water and sanitation committee (WATSAN). As a community-based organization, WATSAN committees are designed to be an instrumental management tool for improving local water resources, as well as promoting the sustainable use of

water under the guidance of external development partners. As the following chapter explores, however, the success of these management committees can be difficult.

CHAPTER 7

RESULTS AND DISCUSSION: COMMUNITY-BASED ORGANIZATION IN WATER RESOURCE MANAGEMENT

Ni ya mè ko saa a kun do
a snake with its head cut off is just a string

– Bambara proverb

7.1 Introduction

As discussed in the previous chapter, community-based organizations known in Bambara culture as a *tóns*, play an important role in village development. Traditional *tóns*, including men's, women's, elder's and youth associations, are considered to be a credible form of community organization that is both familiar and accessible – linking the household to traditional village leadership. However, the ability of these traditional organizations to effect change on behalf of the community is debated. Members of *tóns* are believed to engage for their individual household's benefit and the idea that they function for a collective good may be more myth than reality (Jonckers, 1994; Jones, 1976).

Traditional organizations provide an important link between traditional forms of patrilineal government and households with greater access to power, yet exclude the average household that functions relatively independently within the boundaries of extended families. Jonckers (1994) also explained that the villages with strong traditional systems of community organization may be more likely to fail at implementing initiatives in partnership with nongovernmental organizations (NGOs) or the state. In other words, community-based

organizations (CBOs) established to conduct village-level organization in collaborative efforts are meaningless given the nature of traditional organizations, which are not clearly understood by outside partners. While villages are not uniform, this is a fundamental explanation for at least some of the challenges in collaborative, community-based resource management and development.

The following chapter looks more deeply at the structures of community organization as implemented by an NGO, by examining the local water and sanitation committees established to implement World Vision efforts through West Africa Water Initiative (WAWI-WV) within rural communities. The synthesis below is the result of interviews with 30 members of six existing local water and sanitation (WATSAN) committees, as well as interviews with NGO staff and representatives from various levels of government.

7.1.1 Water and sanitation committees

Water and sanitation committees, known as WATSAN committees, are a fundamental component of community resource management implemented through WAWI-WV water projects. The formation and effectiveness of these committees varied widely from one village to another, although they were established with the same function in mind.

7.1.2 Formation and structure of WATSAN committees

World Vision defines a WATSAN committee as "... a formal organization made up of between 7 and 15 community members, who will plan, raise funds

for, build, own, and manage the new water supply facilities (WV, 2000)." According to WV personnel, there is no specific model for a WATSAN committee. As the WV Ghana training manual describes, a WATSAN committee may be formed according to the unique needs and systems of organization in each community (WV, 2000). For instance, a committee may be formed through an existing CBO or alternatively an entirely new committee may be organized with membership by both men and women. A committee may also be formed by the addition of new members, often women, to an existing CBO to better reflect gender equality in local decision-making. World Vision staff often requested village council to select women for at least half of the committee membership, and to grant them opportunities to hold executive positions (e.g., president, secretary, treasurer). This was done to provide women, who were traditionally excluded from these forums, a chance to participate in local water management. Table 7.1 outlines the core positions that may constitute a village WATSAN committee (WV, 2000).

Interviewees in the local communities described the overall process relatively similar to one another although there were slight variations depending on the size of the village and the discretion of the village chief and council. In all cases, it was WV staff who approached the village council stating the need for a local committee to manage the new infrastructure (i.e., pump, rehabilitated wells). In some of the larger study villages, the village council then asked the individual *quartiers* to identify one or two representatives to participate. Once the household selected the representatives within the *quartier*, these individuals presented themselves to the village chief and council. The group collectively decided on specific roles, based on their skills, past experience in community leadership, and gender.

Table 7.1: Common positions on a WATSAN committee

Position	Role
President/chairperson	Supervise and assign tasks to committee members; organize and conduct meetings
Secretary	Maintain records of committee meetings and water management/repairs
Treasurer	Receive funds for repairs; manage banking transactions; maintain financial records
Collector	Collect funds from households for repairs and new infrastructure
Organizer	Organize community meetings and mobilize community
Health organizer	Provide health-related sensitizations and education for community including water treatment and latrine usage
Caretaker	Regularly inspect water points and provide routine maintenance (cleaning); report major problems to committee

In other instances, the village chief and council took full responsibility choosing the members of the WATSAN committee. Village administration chose these members based on a variety of reasons but in numerous instances, individuals were chosen because they held respect among the men and women of the village and often had previous committee experience. Ideally, individuals selected would maintain year-round residency in the village. Some participants would also have been selected for their ability to read and write, allowing them to maintain records and conduct modest accounting duties. Once the committee members had been selected, a community assembly may be called for final approval from the heads of households in the village. This was usually just a formality since considerable trust was placed upon the decisions of village chief and council. Besides, few would consider challenging such decisions made by their traditional village leader.

The WATSAN committee then completed a number of administrative documents including:

- a declaration of intent to create an association,
- a record of general assembly in the village (community notification and approval of the proposed committee),
- a list of households showing payment of dues (funds to ranging 500 - 1000 CFA per household contributing to the initial repair account, depending on the size of the village), and
- the statutes and internal regulations of the committee.

These documents were authenticated by the mayor of the *commune* and then deposited with the *cerlce* prefect who audited the documents and issued final approval. This process was designed to give the committee authority and legitimacy in the decentralized system of local governance, but perhaps most significantly, allowed the committee to open an official bank account. In rural communities, both the water and sanitation committee and the local *Comité de Gestion Scolaire* (CGS) were formed through this process. The recognition of such associations was approved by law 04-038 AN RM *Relative aux Associations* dated August 5, 2004.

When a pump was to be installed in a village, WV asked village council and the new WATSAN members to collect 100,000 CFA from the households in the community, which was kept by WV for the WATSAN committee. Once the pump was completed and the WATSAN committee had been officially formed, the funds were returned to the committee members for deposit into the WATSAN committee bank account. The statutes and regulations of the commit-

tee often included a wide range of roles and responsibilities. One document viewed in a Diéli community specified that the WATSAN committee must meet monthly and hold a community assembly every three months. The community assembly would allow WATSAN committee members to guide households on the management of the water points and to conduct sensitizations on water handling, hygiene, and sanitation.

In many villages, there may be assistants to the executives and multiple collectors or caretakers. In addition to these particular committee roles, there may be an individual trained to conduct repairs. In the San area, one or two men were formally trained by WV, private manufacturers, or the government to conduct repairs on both foot and hand pumps. These repairmen usually had a mechanical background and were responsible for responding to WATSAN committee repair requests throughout their entire *commune*. In villages housing a formal repairman, they often considered this individual as an extension of their WATSAN committee, even though this position was not formally recognized in the community WATSAN contract with WAWI-WV and was considered a support role to communal WATSAN committees.

If the WATSAN committee encountered a problem with one of the water points or wished to conduct a formal training in the village, a specific process was followed. Once the WATSAN committee was aware of a broken pump, the committee or at least the president presented the issue to the chief and village council. A decision was then made whether to contact a repairman, to collects funds, or not to proceed with any action.

Of the WATSAN committee members interviewed, 60% were men and 40% women. Land size and animal rearing were consistent with other households in

the community; committee members did not have more land or more animals than other households. However, individuals (primarily men) holding WATSAN membership tended to have more non-agricultural employment than the average water user interviewed (Figure 7.1). Of the women, 82% considered household duties their primary occupation.

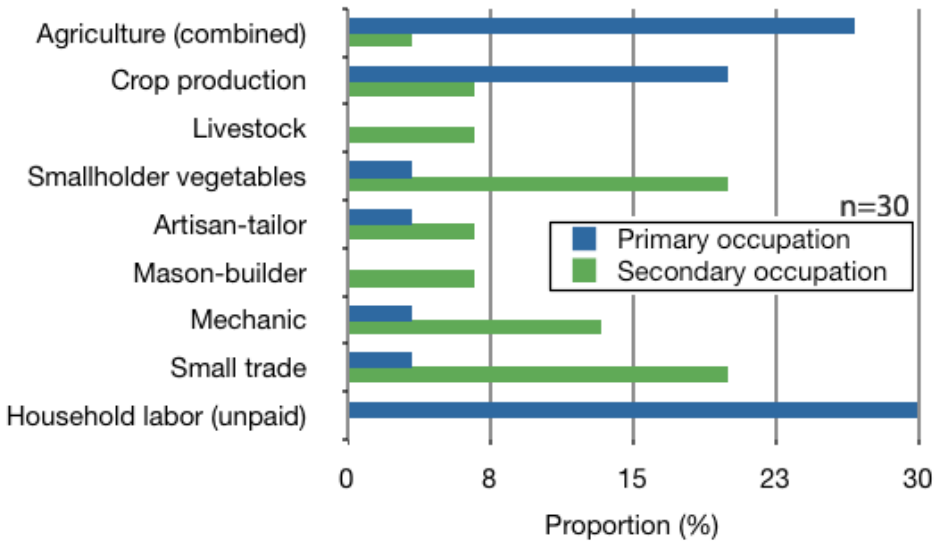


Figure 7.1: Occupation of WATSAN committee members

The education of WATSAN committee members was also slightly different than the general results from the individual water user surveys (Figure 7.2). Members of WATSAN committees had more non-formal and fundamental (basic 1st cycle) schooling than the households interviewed. Only five members (17%) had no formal or non-formal education. This was anticipated since it is not uncommon for executive members of committees to have the ability to read or write in order to conduct the affairs of the CBO. These individuals often had previous experience working on a CBO and therefore it was not surprising they would be selected for these positions.

The designation of positions and responsibilities on the committees was

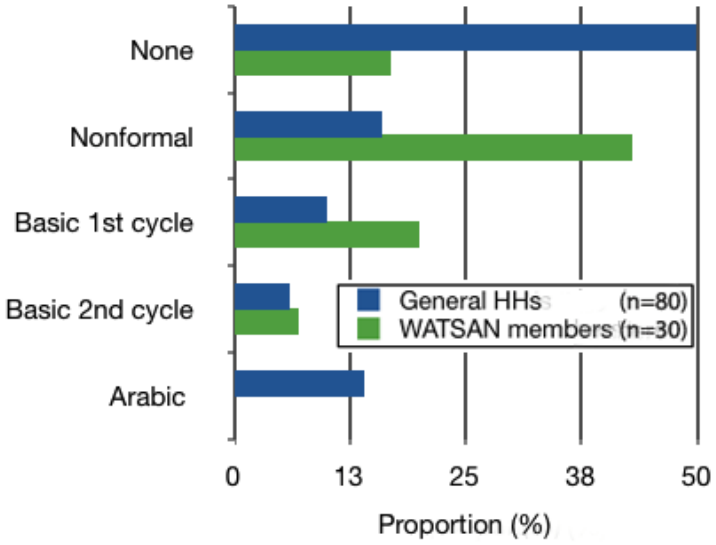


Figure 7.2: Education comparison between local water users and WATSAN members

highly gendered, with slight variations between villages. During the household water user interviews, all respondents suggested men should be responsible for ensuring the availability of water sources in addition to repairing the pumps. Women, on the other hand, were responsible for cleaning and guarding the water point from misuse and damage. When looking more closely at the positions of WATSAN committee members, men and women tended to be assigned very specific positions and responsibilities (Table 7.2). Females rarely held executive positions with the exception of treasurer and were always assigned the cleaning responsibilities of the water points. In addition to the core positions of members, three of the men interviewed indicated they held secondary positions as repairmen. These individuals noted they were provided with a basic level of training by WV in order to conduct routine maintenance on the pumps.

When it came to collecting money from households, most WATSAN committee members indicated that this should be done by men (83% female and

Table 7.2: WATSAN positions occupied by gender

Males	Females
President	Vice President
Vice President	Treasurer
Secretary	Assistant Treasurer
Assistant Secretary	Collector
Collector	Cleaner
Repairmen	
Guardian	

78% male respondents). Respondents perceived that men were able to approach households with greater authority to collect funds, an attribute especially helpful when households were resistant to giving money for pump repairs. With regards to keeping money, however, it was most often women who maintained the position of treasurer. Both men and women expressed the logic in this saying that men often misused money because of their many responsibilities. The fact that men tended to travel more often than women was also noted as an important reason for this assignment. It is interesting to note however, that of the four female treasurers interviewed, two had never once seen the money collected from households, which was supposedly deposited into the WATSAN committee bank accounts.

7.1.3 Capacity development

The training of WATSAN committee members was an important determinant of committee success among communities. Training provided individuals with an understanding of the specific roles and functions of each member, and if done effectively, imparted a common vision among the team to collectively

lead improved local water management practices on behalf of other households. The process of being involved in training also provided members with the confidence and skills to engage with their community more directly on issues of water use and sanitation.

World Vision water and sanitation field staff completed training with both WV and formal trainers from private industry and government. In 2007, WATSAN supervisors from various WV Area Development Programs (ADPs) including Sanké and Diéli, participated in a week-long workshop with Mali Rural Water Project (MRWP) personnel and hygiene and sanitation technicians[1] contracted to conduct the training. The participants learned about the more technical aspects of water and sanitation projects including the treatment of water, latrine construction, hygiene, and sanitation. Attendees were also instructed on how to work with local communities as borehole projects were planned, constructed and managed. The position of a WATSAN supervisor was relatively new in the ADPs, but the supervisors played a fundamental role in WAWI-WV project implementation, which was expected to expand during the second phase of WAWI. The intensive training provided in these types of workshops were extremely important to prepare ADP staff for field activities, who functioned with the support of the MRWP office in Bla on behalf of WAWI-WV.

The community members who participated on WATSAN committees also attended more specialized trainings. In the Sanké and Diéli ADPs, WV staff provided three-day trainings in both Diéli and Sanké for WATSAN members. Although WV had indicated multiple trainings were made available, most committee members had only participated in one event. During these trainings, a

[1]Mali's *Institut National de Formation en Sciences de la Santé* offers a diploma in hygiene and sanitation to individuals holding a bachelor's or engineering degree. Upon completion, a graduate is noted as a *technicien supérieur.*

representative from regional or sub-regional government came to the WV Base to conduct the majority of the instruction. Using animations, discussions, and role playing, committee members were taught the importance of improved water handling, as well as hygiene and sanitation practices such as hand-washing and latrine use. They also were instructed how to pass along this information during community assemblies and other forums to train local water users.

For most of the WATSAN committees, including those interviewed, not all of the members were able to participate in the trainings. In the case of Tiomporosso, for example, members said that only one male and one female were able to attend. Committee members who did not attend said that the attendees were expected to pass along new skills upon their return, although it was felt this was not adequate. Every WATSAN committee member interviewed said that their greatest concern centered around training – that one initial training was not enough and that they would benefit from more regular reminders of how to manage the pumps, and more specifically, how to work with their communities more effectively to collect sufficient funds for future repairs.

7.1.4 Repairs

As mentioned previously, some individual villages had someone trained to do very basic maintenance on the pumps. More casually trained repairmen for basic maintenance often had other technical skills such as the repair of radios and other small devices, although did not necessarily have the mechanical background of formally trained pump technicians. They were, however, selected because of their specialized skill in the village. For major repairs, a fully trained

technician was required. Formally trained repairmen were found to have more comprehensive mechanical experience, usually working on motorcycles, bicycles, and *charettes*. World Vision and the government had been working to train at least one *commune* repair person who was able to serve communities with either the foot pumps (Vergnet) from earlier government programs or the more recent hand pumps (India Mark II) installed by WV. The India hand pumps were the standard pump technology endorsed by the government at the time of the study.

Two communal repairman for the Niasso and Somo were interviewed to understand the nature of their training and experience working in the *communes*. Each repairman received a minimum of two week-long training sessions conducted by the government and WV. During these training sessions, the repairmen learned how to troubleshoot and complete repairs on the two main types of pumps installed in the area. Formal follow-up training had not occurred for these individuals. If they encountered a problem while repairing a village pump, they could contact their trainer in San for advice. During the initial training, the repairmen were provided with the basic tools they would require in the field. The repairmen were reimbursed for the cost of fuel to visit villages and given a modest amount that was generally insufficient as a salary, although it permitted the repairmen to purchase new tools as they wore out.

When a repair was needed by a village, the WATSAN committee or village council notified the mayor's office. The mayor then contacted the repairman to schedule the repairs. Upon arrival, the repairman assessed and repaired the pump. If parts were required, they were usually available in San, while more obscure components had to be ordered from Bamako. As a result, the repair pro-

cess took anywhere from two days to several weeks or months. The delays due to spare part availability reflects serious supply chain barriers to make timely pump repairs not only in rural Mali, but throughout Africa (Harvey & Reed, 2003). Some villages were fortunate to have the trained communal repairman located in their village, making repairs faster and more convenient. After the pump had been repaired, the repairman was reimbursed expenses and paid by the village. The money for these repairs was withdrawn from the WATSAN account, which consisted of funds collected from households in the village.

Both repairmen indicated that foot pumps were easier to repair, requiring only two men to lift and disassemble the pump, whereas the hand pumps required much more manpower. That said, they both indicated hand pumps as their preferred technology, being more durable and easier to repair once disassembled. From their experience, foot pumps were more likely to break down at any moment. The foot pedal becomes dirty and jammed more frequently if not maintained by water users in the community.

7.2 Challenges

Looking at the organization and functionality of WATSAN communities sheds significant light on the reasons why some water projects succeed, while others fail. In their design, WATSAN committees were intended to provide their community with a clear system of organization to oversee and respond to the needs of water users. They were intended to not only ensure the operation of water infrastructure, but also to provide a transfer of knowledge with regards to safe water handling, hygiene, and sanitation. These activities should have sup-

ported general water resource management in the community, although they rarely seemed to do so and the reasons often confounded one another.

Households, for instance, were quick to receive the blame for nonfunctional boreholes. The cause was often attributed to community members' refusal to contribute funds for repairs. Upon further probing, however, it had become evident that it may have more to do with the final authority of a village council, the complacency of key WATSAN committee members, or perhaps more simply, a lack of communication between stakeholders. Some key challenges to the sustainability of water projects with regards to the role of WATSAN in the community are described in more detail in this section, reflecting issues raised by government, NGOs, local communities, and committee members during the various interviews.

7.2.1 Membership

The manner in which the WATSAN committee was formed reflected the traditional authority of local communities. Members were selected rather than by volunteering. This translated into a sense of obligation for some rather than an enthusiastic commitment to community management. The purpose of WATSAN though, was much less traditional and more representative of a modern Mali – one that is responding to a decentralized, and more defined civil society at the local level. It was, at least in part, because of this disconnect that an NGO-organized committee struggled to function in a traditional community. These committees were, in essence, designed to fail.

A few individuals interviewed commented on WATSAN membership dur-

ing the household surveys, saying that they would appreciate the opportunity to serve if ever given the chance. Unfortunately for these aspiring individuals, many of them would never be considered for such a position. The average water user in the community does not have a connection to village authority and would never have played such a role in the past. Also, very few committee members were ever elected or even nominated for the position, a possibility restricted to larger communities with multiple *quartiers*. Even so, people often remained in these committee positions for years, even if their performance was sub-par. The systems to remove ineffective individuals did not exist and therefore households were more likely to passively accept a committee's inaction.

Participation, as defined by outside partners such as NGOs and funding agencies, was not understood in the same manner by a local community. Participation was generally restricted to a few in the village. The chief and council worked directly with the mayor's office and external partners. They made the executive decisions, sometimes with limited input from heads of households or *quartier* representatives, at least from those who voiced their opinions during community assembly. WATSAN was only established in order to prepare for the management of water infrastructure or hygiene and sanitation projects. Members, unless associated with village administration, were not involved in the planning stages of the project. This may have had a detrimental effect on project ownership and commitment of those effectively managing collective property on behalf of their community.

This situation was best exemplified by the success of local water resource management demonstrated in Niamana-Masoumana. A number of members of the WATSAN committee were also part of their village administration. As a re-

sult, these members worked with WV to initiate the borehole project in the community, identified preferred locations for water points, and then participated in the formation of the committee and subsequent WATSAN training. This was the only committee that reported regular communication among members, sensitizations for the community, and functioning pumps, despite the need for multiple repairs.

A group of men from Bankouman-Bobo offered further explanation saying that, "Once you understand what it is you want in the community, it is easier to work with an NGO partner." They, like numerous others in the communities surveyed said, "If a community has a shared interest in the project and participates in planning and management, they have ownership and clarity in their roles, making the project last." These individuals were referring to their experiences working with a range of development partners on projects in their village. Another man from the same village spoke about his involvement with the government rural development project, PACR, where he and other farmers were asked to help design a new agricultural goods storage facility. He said, "We spent three days with the man, participating in the planning. It was interesting for those involved and positive for our community, teaching us what is possible."

7.2.2 Commitment

The actual time investment a WATSAN committee member makes can be reflected in project success. As mentioned earlier, members could be selected based on a variety of skills or expertise they may be able to bring to the com-

mittee. World Vision also asked council to consider the selection of individuals based on their residency, although this was clearly not followed. The study found that key members were often away from the village for months at a time. During these periods, committees lost track of collecting funds and making arrangements for repairs. Prolonged absences by committee members may have further contributed to extended durations of broken infrastructure if the remaining committee members either could not or did not feel obliged to proceed with repairs or the collection of funds.

Most committee members were very honest that they did not hold regular meetings, nor conduct formal sensitizations regarding water, hygiene, and sanitation. One member said that despite being trained by WV for both repairs and community sensitization, the latter was rarely conducted. He said, "Since the committee was formed [three years ago] we have had one committee meeting and have never held a community sensitization." He added, "If someone wants to know how to treat their water, they ask us. World Vision does not seem satisfied with what we do, so we need to convince people within the committee to have meetings." In one of the larger villages, local administration and a few of the members indicated the WATSAN committee held meetings on regular basis. However, after interviewing each member individually, it was clear that the committee had never actually met since its formation, nor were these individuals even sure who the other members were or what positions they held. Obviously, holding a meeting does not directly translate in effective management of a resource, but it does maintain a certain degree of continuity and presents a regular forum for committee members to discuss issues relevant to community water management.

Another issue that was raised in one village was a direct criticism to the influence and actions of younger generations in the community. Young men were returning from work abroad in time for the rainy season telling stories of development projects in other villages or cities. They were under the impression those managing projects were being compensated for their participation. As a result, these individuals were voicing their resistance to contribute to projects in their own villages until such compensation was made available to them, setting a strong precedent in the village. Whether the stories they shared were true or not, the issue of compensation was a serious challenge to participatory development projects. Although not widely expressed, a few WATSAN committee members felt as though the amount of time expected of them warranted some sort of payment. This only seemed to be an issue with NGO facilitated projects, as opposed to village initiatives, within this particular village. Some WV staff said that part of the reason members of WATSAN committees requested so many trainings was that in some instances (not necessarily WV trainings), they were provided with either a per diem or meals. This was believed to be a major draw for participants.

7.2.3 Perceived lack of training

With regards to training, the majority of concerns had to do with access to a more local repairman and how to work with households more effectively. Many committee members were concerned that they were not prepared for the confrontation and resistance received from households. In Tiomporosso and Bankouma-Bobo, the pumps were initially locked outside of peak collection times. Water users quickly became angry about the restrictions with this prac-

tice. When the guardians stopped locking the pumps, committee members said the pumps were broken almost immediately. Committee members expressed concern about how to collect funds more efficiently from households. To avoid the need for this periodic collection of repair funds, one of the villages had tried to charge water users per container (*bidon* or bath). Community resistance was so significant, this method of WATSAN fund collection was short-lived.This appeared to be an important part of WATSAN committee training that needs additional attention from government and NGOs, beyond the more technical aspects of water management taught during initial committee training sessions.

Training an individual to conduct technical repairs on different types of water pumps is both costly and time-consuming. To resolve this in the San area, WV and the government had determined it was more efficient to train a smaller group of individuals to a higher level, provide them with the tools they needed, and then assign them the responsibility for repairs over a larger geographical area. In Téné for example, there is one repairman responsible for three surrounding *communes*. The problem, according to a few local communities examined, was that having to contract a repairman from outside the village often extended the duration of the necessary repairs and increased the cost to the village. At times, the issue seemed deeper than just the WATSAN committee having to convince the village to contribute funds to cover the cost of repairman's expenses and parts. It seemed as though, at least in one of the villages, there was a significant aversion to having an outsider come to the village to repair their broken pumps. Regardless, this frustration translated into a negative perception of the limited training made available to local committees.

Some communal administration, as well as village councils and local water

users, felt as though both the WATSAN committees and the local men trained in basic maintenance were inadequately prepared. Mostly this was centered around the fact that these individuals had neither the tools nor funds to conduct thorough repairs. This was true although, the men were never trained by WV with the intention that they would be responsible for technical repairs. It did not make sense to fully train an individual in a village that may not need such services for months or even years. The trained community member would be more likely to lose proficiency of their skills before being able to apply them in their own village. That said, villages did not want to (and often could not) pay for the training of a repairman or for the tools required. Perhaps both as a compromise and as a way to better maintain local infrastructure from failure due to gross misuse, some of these local men were trained by WV in the villages to conduct very basic maintenance and repairs. Regardless, when a pump failed and the local WATSAN member did not have the skill or equipment to make the repairs, much of the blame fell on the project partner, as was the case for WV. This occurred despite implementing a more manageable system to serve a larger population through a single, more highly-trained repairman.

7.2.4 Ability to collect funds

Each WATSAN committee in this study conveyed examples of problems collecting money from households in order to set aside funds for future repairs. According to these committee members, households were reluctant to provide money for something that was perfectly functional. The mayor and council in Diéli noted that despite nearly two-thirds of pumps in the *commune* being non-functional, they felt as though the local WATSAN committees were effective.

From their experience, they believed that the problem was with households becoming reluctant to deal with multiple repairs. They said, "People pay into the first collection for repairs and then the pump breaks down. After that, people don't want to pay again for repairs." A female household water user from Bankouma-Bobo suggested it may more efficient to develop a consistent schedule to collect funds. She said, "I think it is easier for people to pay very small amounts more frequently than a single large amount when repairs are needed." The collection of funds, of course, is preferred to occur in this manner. However, individual WATSAN committees and village leadership have the control to devise alternative systems for their communities, outside the suggestions made by project partners.

One additional suggestion from respondents was for women to collect funds from women, while men collect from the other men in the village. Much of daily life is highly segregated between males and females in rural Mali. This would make it easier for those responsible to collect money for repairs and maintenance. It may also be possible that women would be able to collect a substantial amount of funds from women because of a grounded appreciation for a functioning pump, as the primary water users in the community. Many women also had growing incomes available for such investments through the expansion of vegetable gardens and small trade in the study villages. Contributing money to collective causes was already commonly practiced among small groups of women, whether for assisting others with health expenses or organizing social events. Men, on the other hand, tended to contribute to these projects out of a sense of obligation or respect for village leaders. The value of community sensitization and continual education for both men and women would be beneficial, not only from a direct health standpoint, but to also regularly highlight the im-

portance of supporting and maintaining such infrastructure in the community.

Another perceived challenge faced by collectors in larger villages was the location of water points relative to households. An administrator in Téné explained saying, "If I were chief, and asked one *quartier* of the village to pay for the repairs of the pump located in another part of the village, that would create bad feelings among some residents. People don't want to pay for repairs for something they don't have the same access to." As identified in the water user surveys, the locations of households relative to boreholes can be highly variable. The results also suggested that the location of the borehole did not necessarily determine borehole use. There were numerous instances where an individual lived relatively far from a pump compared to other households (e.g., households in Daelan-Sobala), yet they believed strongly in the quality of water available at the boreholes. The extra time and effort for borehole water collection was worthwhile to these individuals. Convincing water users to contribute financially to the maintenance of infrastructure appears to have more to do with their perceived value and benefit to their household, rather than inconvenience or unequal access. Thus, it seemed as though sensitizations and positive personal experiences from using the water sources were an important impetus for household participation.

7.2.5 Authority

The lack of ultimate authority among members of the WATSAN committee was a significant challenge to the management of water infrastructure in a community. Although the committee was a recognized entity according to the

commune (and *cercle*), the committee relies on the final authority of the chief and village council in order to proceed with repairs or to mobilize the community to collect funds. Unless the chief and council was in agreement with the committee to repair local water infrastructure, the committee had little power to follow through on their mandate to oversee the function of pumps in the community.

One household water user described the situation as a problem of organization in the village. She said, "No one is responsible for the work so nothing is being done. The pumps have been abandoned and we must repair them. Someone came here to help us do this at one time, but we were not organized and did not maintain the process." In two of the study villages with broken pumps (Tiomporosso and Bankouma-Bobo), both the WATSAN committee and village council insisted households were preventing repairs. The water users interviewed, including those who participated in focus group sessions, conveyed a much different story. They overwhelmingly insisted their households were ready to contribute funds as their community was in dire need of more secure water sources. When the WATSAN committees were asked to explain the situation further, members indicated that they were waiting for the council to make the next move to proceed with repairs. In the village of Bankouma-Bobo, this had been going on for multiple years. Because of the traditional authority of the village administration, the committee was reluctant to take initiative on behalf of the local water users they served.

7.3 Closing comments

Throughout the field work, it seemed that government and NGOs were often perplexed at the continued failure of WATSAN committees and the management of water infrastructure. Indeed, there were households in every community that refused to contribute funds for repairs, or that did not see the value in water points. Continued education and sensitization regarding the value of contributing either financially, or through some other form of local participation, would no doubt help committees mobilize their community's households. However, despite the resistance of these individuals, the vast majority of households appeared to support a collaborative form of development promoting local resource management. The question then became, why do community organizations in Mali fail to function at managing the outcomes of development projects when they are the foundation of participatory development in other parts of the world?

Within these communities, strong systems of traditional organization exist to carry out tasks to manage resources and further local development. As mentioned at the beginning of this chapter, but the ability of these traditional CBOs to effect change for the collective good is a contentious issue. Traditional organizations in Bambara culture function based on collective trust in decision-making. The idea of more Western processes, such as electing members or voting on issues, implies that members are unable to reach consensus. The very idea of trusting the decisions made by local leaders and the values of consensus and acceptance are highly regarded by Bambara households (Buijsrogge, 1989).

In development projects, the natural instinct by the project partner in many

of the communities examined, was to develop a new CBO to oversee the maintenance and repairs of water infrastructure. These committees were also expected to train fellow households in water management practices to protect local water resources and to improve hygiene and sanitation. Members were assigned specific executive roles and organized to follow democratic processes, both within their committee and in community forums, to make collective decisions regarding water resources. Because these systems were not compatible with existing systems of social organization or patterns of decision-making, it was not surprising these committees struggled to carry out their defined responsibilities. There was a significant disconnect between the traditional authority followed in communities and project partner collaboration, and it distilled down to who in the community held legitimate authority.

Besides the fundamental issue of authority and legitimacy of CBOs, there were obviously a number of other challenges to community organization. These challenges impacted the ability for members of communities to improve local resource management through development initiatives. Despite efforts by external partners to involve women in decision-making, positions of influence and authority were were left for men – echoing the experiences of WATSAN committees in Ghana (Opare, 2005). For both men and women, participation on a committee was a major commitment, and at times, difficult to manage. Some committee members did not even know who their fellow members were; others were unable to mobilize themselves to conduct their mandated roles, including repairs and community education. The manner in which committee members were selected, personal commitment to a particular cause, access to training, and the ability to mobilize other households to contribute to the perceived collective good, have all been discussed in this study. With the exception of one vil-

lage (Niamana-Masoumana), all of the water and sanitation committees in this study were arguably nonfunctional. The single successful committee demonstrated a commitment to local decision-making and motivation by a select group of individuals rooted in traditional leadership. As a result, the committee held both authority and legitimacy in their communities. All of these characteristics were lacking in the five remaining committees (Ténéni, Diakourouna-Nirisso, Tiomporosso, and Daelan-Sobala). This observation highlights the failure of formal institutions to manage local water resources in these study villages. Traditional systems of social interaction and reciprocity may be better suited to respond to the overlapping interests of all water users (Cleaver, 1998).

If the preferred outcome of water projects is to improve community water resource management, then perhaps the involvement of key players in community organization should be embraced despite the exclusion of most households. If the outcome of improved water resource management is to have a broader impact among stakeholders, such as to influence behavior change, current initiatives have to consider development as a larger system. Identifying the challenges that may arise while using existing organizations, or when forming new CBOs, may aid in adapting to the changing needs and expectations of stakeholders. These challenges can be anticipated by understanding local systems of organization and recognizing their values and constraints in community-based resource management before appropriate tools for collaborative development are implemented. However, a recognition of community organization is only one component of the system – issues of education, health, environment, and household poverty are interrelated and should be approached as such while implementing targeted development projects. Community-based water resource management in rural Mali involves meeting the immediate needs of households

while planning for longer-term environmental stresses in changing contexts (Day, 2009).

The next and final chapter presents a discussion of the overall findings as they relate directly to the initial research questions outlined in Chapter 1.

CHAPTER 8

SUMMARY AND CONCLUSIONS

8.1 Summary

The West Africa Water Initiative (WAWI) is an example of a collaborative effort in international development aimed at improving rural livelihoods. As a research and development partnership, WAWI works to foster collaborations and improve community capacities to attain safe drinking water, hygiene and sanitation, and sustainable practices in resource management. Using WAWI as a case for exploration, this study investigates water resource management in the *Cercle de San* of south-central Mali based on water projects implemented during the program's first phase from 2002 to 2008. Field research was completed between 2006 and 2009. The core field research was conducted in 2008 in nine rural villages with varying degrees of familiarity with water development projects implemented by WAWI's lead agency, World Vision (WV).

Data were collected using complementary mixed methods, including open-ended interviews, focus group sessions, household (HH) surveys, and a review of WAWI-WV documentation. A gendered analysis identified different water needs and degrees of participation in resource management between men and women in rural communities. To gain perspective of all stakeholders in community development as a system, local, regional, and national government representatives, and nongovernmental organization (NGO) staff responsible for managing and facilitating WAWI projects, were also interviewed. The goal of this analysis was to better our understanding of collaborative-based development interventions designed to improve water resource management, and more

broadly, natural resource management in rural West African communities.

8.1.1 Research questions

To discern these goals based on the provision of water to rural communities through the West Africa Water Initiative, the following discussion returns to the research questions introduced in Chapter 1 and to the initial conceptual framework outlining the theoretical basis of the analysis in Chapter 2 (see Table 2.1). The table below (Table 8.1) reflects on some of the key findings of the analysis in consideration of key structural (institutional) and behavioral (collaborative) mechanisms framed by the dimensions of collaboration, gender, participation, social capital, and social learning. These findings are discussed in more detail in relation to the specific research questions.

Table 8.1: Reflections on structural and behavioral mechanisms identified in analysis

Dimension\Variable	Behavioral Mechanisms	Structural Mechanisms
Collaboration	Accepted traditional roles in decision-making to manage local resources Members of HHs expect village leadership to seek out and work with external partners in development	Goals between stakeholders often conflict; for instance, community members may envision development goals differently than project partners (e.g., construction of a school rather than new water points) Government systems of decentralization have resulted in tiers of policy oversight of community water resource management; the *commune Programme de Développement Économique, Social et Culturel* (PDESC) report can impact local resource management through local development projects with outside partners (NGOs and government) but the government has limited resources to assist local government and village leadership
Gender	Women and men have distinct roles in local resource use and HH economic activities Men hold majority of decision-making control in the HH (women play an important role in HH decision-making, but can be limited by lack of resources); men also have more opportunities to engage in community decision-making, but are also limited by power imbalances and traditional authority	Newly formed community-based organizations (CBOs), such as water and sanitation (WATSAN) committees, are required to include women (their role is often limited to cleaning water points or to provide token roles (e.g., a woman assigned as treasurer without actually handling committee funds) The networks and organization of existing traditional women's associations are underutilized by NGOs and government
Participation	Members of HHs, both men and women, expressed interest to participate in community planning and projects although acknowledged few opportunities exist Women suggest it is the accepted norm for men to engage in local decision-making on behalf of other members of HHs Roles within WATSAN are commonly misunderstood	Project planning is limited to NGO, village leadership, and to a lesser degree, communal government (the direct role of the mayor's office is greater in the capital of the commune where they hold office than in surrounding rural communities) Community forums are an important venue for local participation although final decision-making is often limited to the village chief, council, and heads of households (primarily male-headed HHs) Members of WATSAN committees are often selected by village leadership, without consideration of their actual interest or ability to participate Minimal use of other existing traditional CBOs and their members in project planning and implementation

Table 8.1: (Continued)

Dimension\Variable	Behavioral Mechanisms	Structural Mechanisms
Social capital	Women hold trust in decisions of husbands and in the men of the community; members of HHs, more generally, hold trust in their traditional village leadership Exposure to local development opportunities appears to increase interest to improve local resource management and community development	Relationships in projects are generally established between traditional village chiefs and councils and external partners, although at times, leaders from traditional CBOs are consulted and included in WATSAN committees to manage resources and promote community development Access to education and limited past experience in community planning are barriers to participation (an individual is less likely to be assigned a position by traditional village leadership without these attributes, despite their interest and motivation) Traditional CBOs (particularly women's and youth associations) are underutilized
Social learning	Mobility of community members is an important influence on the awareness and adoption of practices and technologies to improve local water resource management Local NGOs and community health centers conduct trainings in water management, which do not always translate into behavior change unless members of HHs experience and understand the benefit, and are able to prioritize the practice as a HH need Past experiences with NGOs and government can influence perceptions of resource management through development projects (positive experiences leaving members of communities optimistic, whereas negative experiences leave individuals skeptical)	No evidence that traditional knowledge is incorporated in development partnerships although sensitization efforts and community trainings do consider local settings and literacy (the use of visual materials, role playing, and performances)

What is the evolution of water resource management in rural south-central Mali?

Villages in the San area were founded along the Niger and Bani rivers, and their tributaries. In each village, an initial well was hand-dug using traditional knowledge, serving the early water needs of the founding households. Although subsurface conditions in the region have made well construction a tenuous task, additional wells were completed in response to the needs of growing populations, and out of necessity during times of water scarcity. These year-round water sources satisfied communities as long as annual rains replenished groundwater and surface supplies. Over the years, there were few rules on use, except during periods of drought and when new, natural sources appeared during prolific rainy seasons. During these periods, the chief and village council often designated specific areas along ponds and rivers for use by humans and livestock. As the size of the villages grew, additional wells were established until eventually private hand-dug wells could be found in nearly every household compound.

The shifting roles and responsibilities in water resource management are indicative of Mali's evolutionary political context. Colonialism retracted traditional power from community leadership and placed it into the ascendancy of foreign administrations. As Mali transitioned through various periods of political restructuring from independence through democratization, control over natural resources remained with the state. More recently, the government has moved most water resource management programs from national administration to the regional and communal levels through decentralization. Periods of significant drought garnered worldwide attention and the government responded with a series of programs with foreign assistance during the 1980s and

1990s to install boreholes throughout the country's water-scare communities. Despite the implementation of participatory development projects by both government and NGO partners, rural communities continue to be excluded from the decision-making process. NGOs funded by foreign partners have garnered an increasingly powerful role in local resource management, as they provide basic social services to communities unreached by limited government resources – a role that has been further institutionalized through the five-year communal development plans, known as the *Programme de Développement Économique Social et Culturel* (PDESC).

Access to land and water resources by farming households is also under increasing stress as the national government partners with foreign investors for large-scale agricultural schemes, dam projects, and industrial ventures. Whether for financial gain or food security interests, the number of land grabs by foreign investors is increasing in Africa (Zoomers, 2010; Cotula et al., 2009; Cotula & Vermeulen, 2009). Rural households are often the most vulnerable in these transactions because of the overwhelming lack of transparency in these deals and the limited legal procedures available to protect local interests (Cotula et al., 2009). Subsistence farmers along the Bani and Niger Rivers face significant changes in downstream water availability, and in some cases, the loss of traditional farm lands and fishing grounds as government contracts out vast expanses of land along Mali's waterways.

The historical context of water resource management in Mali, particularly since decentralization, highlights the importance of an additional element of development projects – community ownership. A history of failed development projects has a negative impact on households, creating complacency and indig-

nation towards future opportunities with external partners. As people become more aware of their rights and understand the capital available to them, they gain stake in a project. Once an individual actually experiences both the process and the benefits, social learning should evolve to behavior change. It is at this stage, that development projects can become more successful. The development of social capital in rural communities can be instrumental for successful collaborative management of local natural resources (Pretty & Ward, 2001). However, there are a number of opposing factors to this process in Mali.

Even with the adopted systems of democratic decentralization, traditional administration is highly valued at the community level. Traditional organization often comes into conflict with the design of projects implemented by outside partners because their durability and value is discounted. By working with traditional norms and behaviors rather than fiercely trying to change them through idealized views of development, rural development partnerships will become more sustainable in Mali. And while working with traditional systems of organization is important, so are the links with government. The relationships between the government and stakeholders, such as NGOs and rural communities, are often problematic and require more attention in development partnerships than they have been granted in the past. Government institutions are part of the larger system of water resource management, supporting activities at the local levels through policy implementation and when possible, physical infrastructure and technical expertise. The government must ensure that NGOs and other development partners are working in the best interests of rural communities and their surrounding natural environments.

What makes a viable intervention in water resource management?

Throughout Mali, there are hundreds, perhaps thousands of failed water projects. Hand and foot pumps are installed in villages with the good intention of improving water supplies, although inadequate management and maintenance are detrimental to their sustainability. Resource-poor communities and individual households struggle to provide the capital to manage and repair equipment. At times, community organization cannot meet the expectations of project partners, leading to a further decline in infrastructure, management, and community support. Government agencies, many still grappling with decentralization, work at the local levels to train administrators and to implement numerous programs aimed at supporting their communities. Their meager resources hinder widespread initiatives, leaving many local and international NGOs to fill the gaps in rural communities throughout the country. The multitude of external partners aiding in village development has had varied success working in these villages. The different approaches used by partners, as well as varying degrees of community participation encouraged and employed, have led to highly variable project success as perceived by local communities. As a result, rural villages have reasonable skepticism regarding the outcome of development projects, despite continuing to look for new opportunities to develop human and economic capital in their communities.

Among these challenges, success stories in local resource management are evident in many communities. There were numerous households expressing enthusiasm about local water projects, claiming new infrastructure had positively changed various aspects of their livelihoods. There was even evidence of highly functional water committee management, despite numerous instances of dysfunctional organization. The success of interventions in water resource

management was highly variable, depending on community organization, government and NGO approaches, and past experiences in water projects. Both the successes and failures in community-based resource management, as influenced by development partners, must be recognized to adapt development approaches for the communities they are intended to serve.

When asked what distinguishes successful water projects from unsuccessful projects in a rural community, one administrator from the government water ministry, *Direction Nationale de l'Hydraulique* (DNH), suggested it required three components based on his department's level of involvement in community-based development. "First, there must be strong human resources." This includes both the motivation of key players and the provision of training, particularly at the local levels (*commune* and village). "Secondly," he added, "a thorough technical research process to understand the geophysical characteristics of the region such as exploration, testing and aerial maps. And finally, to use quality technologies in communities." His summary is indicative of his role in guiding the technical aspects of water management in his country, but lacks additional consideration of the complex nature of development and its implications on resource use and management – particularly the nature of the relationships between stakeholders and the acceptance of traditional organization rooted in rural households to carry out the means of local resource management.

The strength and duration of partnerships are one of many key elements impacting the sustainability of community-based resource management (Berkes, 2007). World Vision is viewed as an important partner in rural community development in the *Cercle de San*. Even when projects had not gone as planned, such as a pump sitting in disrepair for several months, the community spoke

very highly of their relationship with the NGO. This is because local development covers a wide range of activities and the organization maintains a significant presence in the communities. This degree of involvement dilutes frustration with any particular project.

In contrast, households experienced abandonment as a result of nonfunctional foot pumps installed by the government in the area during the 1980s. These projects lacked community involvement in comparison to those more recently employed by WV. Of course, there are other reasons why community members may view the government negatively. Most adults have lived through Mali's *coups d'état* and drastic shifts in political leadership. They now have communal governments collecting local taxes and controlling development initiatives. Most households do not seem to trust *cercle* and communal government, as for many, it seems like an extension of the colonial systems of rule. Furthermore, although households lack faith in their government administrators, studies suggest that the system of decentralization in Mali is rife with inefficiencies and that a superficial recognition of traditional systems of governance is at the root of these problems (Hellevik, 2004; Onibon et al., 1999). Experiences from Mali's forestry sector suggest the necessity for improving collaboration among diverse stakeholders to "...reconcile the ecological and social realities of local NRM with the administrative and political structures of government..." (Benjamin, 2008, p. 2274). Decentralization does not mean a transfer of power to rural communities, but it does create an opportunity for stronger collective management. How these opportunities evolve in Mali has tremendous consequences for subsistence farming households along the Bani River.

Although made murky by policy, the practical roles and responsibilities between government, NGOs, and communities in collaborative development are relatively clear. Mali's national policy is essential to direct local resource management in a democratic society, despite government's limitations to do much more. At the communal level, government provides administrative support, but functions mostly as the formal intermediary between the state and traditional village government. Past experiences and traditional norms make most households cautious of government, although village chiefs and councils know that they must work with the mayor's office to secure any government support for local development.

The *commune* relies heavily on the support of local and international NGOs to implement projects. Nongovernmental organizations follow the requirements imposed by communal government, although in practice they hold the greatest power in the development planning processes. Villages, in turn, rely on NGOs for the majority of the physical and financial capital in community development. Households are fully aware that unlike the government, an NGO has no obligation to assist their community and at least with WV, value the partnership they feel they have been privy to over the years. Perhaps one of the most significant findings pertaining to this research question is the institutionalized power of NGOs in rural development. The role of external partners in community development has a direct impact on the decisions surrounding local natural resource management.

Appropriate technologies, relationships and trust, positive past experiences, and the integration of traditional systems of government in the context of decentralization are all important elements to durable interventions in water resource

management. However, this leads to two additional elements of successful water projects: traditional authority and gendered participation. Within communities, traditional chiefs and councils have complete decision-making authority. While culturally important, this ultimate authority undermines participatory development efforts, as they are currently implemented in the *Cercle de San*. Water and sanitation (WATSAN) committees lack decision-making capacities and legitimacy to collect funds and organize repairs.

The inclusion of men and women in development initiatives is an important means of empowering marginalized populations and engaging them in local resource management. However, as the research showed, the inclusion of both men and women is often superficial. This is especially visible for women, whose participation in community decision-making forums newly formed community-based organizations is minimal outside the household sphere.

The disparities in participation and authority must be recognized to empower households and provide basic social services, such as water. Currently, development efforts are positioned to further marginalize individuals and delegitimize community organization, to the detriment of sustainable resource management and rural development.

> *Do local experiences with WAWI projects lead to changes in patterns of natural resource use, changes in the ways individuals interact within the community, or other unintended consequences of intervention design?*

This is, perhaps, the most difficult question to address based on this research project. However, it is reasonable to conclude that rural development projects lead to changes in livelihood opportunities, which changes labor requirements

and consequently, decisions surrounding natural resource management.

A revealing finding in this study was the prevalence of young boys assisting their mothers and sisters with water collection. This was most noticeable in communities with hand pump technology. Water collection has traditionally been the responsibility of women and young girls in Mali. Now, women and children (both males and females) collect water. The significance of this change is that young boys often use donkey carts or bicycles to collect water, which is much faster than single trips by foot and bucket. Also, it significantly reduces the amount of time women traditionally dedicate to daily water collection. As a newer technology in the villages, pumps are more appealing to younger generations. This has the potential to significantly affect longer-term development. Children are becoming actively engaged in the development process as water users. Young boys, who will one day manage households of their own in traditional villages, will have a greater appreciation for functional local water infrastructure and the preservation of potable water supplies for their families. Many young women already have this appreciation, but women have played a very different role in local water management than men in their villages. From a gender-analysis perspective, a real change in water collection roles will be evident if girls also start using the donkey carts or bicycles, which is traditionally in a male's domain. Over time, these gendered roles and relationships will no doubt continue to evolve.

Additionally, there has been a distinct change in water resource use among rural households in the *Cercle de San* since the onset of WAWI projects. Water collected for the household typically comes from different sources. When borehole water was available, the majority of households used this source for

drinking water. Some households also used pumps to collect cooking water, but only a small fraction of survey participants collected all of their domestic water from local boreholes. Regardless, pumps were always associated with drinking water. Water for other household purposes, such as cooking, cleaning, laundry, and feeding animals, was collected from either private household or public traditional wells. In villages without functioning pumps, water was collected from preferred sources for different purposes. For instance, newer garden wells were used for drinking water, whereas private household or public traditional wells were adequate for all other water uses.

It was not clear whether the installation of boreholes by WAWI-WV in five of the study villages had been the direct cause of increases in the number of private gardens and livestock holdings, although households alluded to these perceptions. This could not be measured because a baseline was not available. At least collectively, the installation of pumps, traditional wells, and community garden projects were perceived as a positive change for these communities. A number of households provided anecdotal assessments of these changes, indicating that the presence of new boreholes had raised the water level in private household wells. Because of this, many believed they were now able to use water to grow vegetables within their household compounds. For those households with livestock, interview participants believed that increased available water allowed them to purchase and breed more animals. Previously, households would not have been able to feed these animals during the dry season, when they struggled to collect enough water for basic family needs.

WAWI-WV projects provided 267 boreholes in Mali between 2002 and 2008 (Jackson & Apambire, 2008). Prior to these boreholes, conflict between water

users had been a significant problem among men and women in at least two of the study villages. Residents interviewed described traveling long distances and depending on neighboring villages to collect small amounts of drinking and cooking water for survival. Women would fight around wells while waiting for water to rise, often going for days without adequate sleep to ensure their turn to draw a bucket. With boreholes, this type of hardship no longer exists in these communities. The nature of conflict has changed and mellowed around water resources. Sometimes the wait endured at boreholes was a frustration for many women, but this did not equate to the troubles previously experienced.

While water-related conflict has decreased among rural households, other challenges remain. In each of the study villages, households were aware of various new technologies and practices that they believed would improve their livelihoods. However, these technologies and practices were not always implemented by households. There were a number of reasons for this, including limited financial and human resources within households. It was possible that only households who experienced a personal benefit as a result of a new technology or practice, went on to adopt behavior change. Whatever the underlying causes may have been, households prioritized their needs differently from one another.

With regards to unintended consequences of intervention design, WAWI projects were not infallible. Despite efforts to raise community participation in development to strengthen local resource management, not all villages had been able to maintain infrastructure and follow improved practices for the handling and use of safe water supplies for the household.

Households living in a village familiar with the struggle to collect water were not more likely to better maintain existing infrastructure any more than those in a village with more secure sources of safe water. Bankouma-Bobo, for instance, had functioning pumps for several years. Once these water points broke down, households did not feel as though the repair of pumps was essential given adequate water supplies in traditional wells. Even in villages with histories of drought and water-related conflict, such as those in the Diéli Area Development Program (ADP), the outcome was similar. In Tiomporosso, households' initial reluctance to contribute to pump reparations and further poor management of the repair process by both the WATSAN committee and village council, has led to extended periods of pump disrepair. Pumps remained broken in Diakourouna-Nirisso despite the recollection of tremendous hardships endured by households during water scarce years.

Villages such as Niamana-Masoumana, on the other hand, benefit from effective WATSAN committees. The strong commitment to improve local water resources in such communities is the rarity, rather than the norm. Although it is easy to associate many of these patterns of behavior with complacency, rural livelihoods in the region are complex. Poverty, environmental stresses, cultural norms, and personal experiences are integrated into the challenge of community water resource management, necessitating adaptive solutions to dynamic livelihood needs.

> *How do men and women perceive their roles in decision-making in a global collaboration model as exemplified by WAWI's programs in local water resource management?*

Using a gendered approach in the field identified highly structured and segregated roles between men and women in the San area. These differences were

found in traditional relationships, access to decision-making, contributions to labor, and use of local natural resources at both the household and community levels. Women were generally required to complete all of the basic tasks individual households require to function – cooking, cleaning, rearing children, and the collection of firewood. Men on the other hand, were responsible for agricultural production and often delegated many related responsibilities to women and children to assist with animal rearing, field preparation, and crop production and harvest. In addition to the specific tangible tasks men and women managed, men and women were also divided with regards to the management of the resources, which defined their daily responsibilities.

Ultimate decisions affecting the community as a whole always remained in the hands of the village chief and his council. Traditional community leadership was valued and trusted among all households. Besides traditional leaders, the heads of households – who were overwhelmingly male – had access to decision-making in community forums. At the very least, they had the authority to contribute on behalf of their respective households, even though the power retained among men was not always equal and many men were also excluded from participating in community resource management and development. Although they were not excluded physically, the authority and legitimacy men retained among fellow households was not shared equally just because of their gender. Traditional leadership was the final authority for all decisions affecting the community, including the use of water resources.

Within the household, the head maintained final authority, though women provided valued input to discussions involving significant household decisions. Many women did have a platform to contribute to decisions impacting the

needs of the household, but were excluded from the public spheres of influence. As was the case for men in community forums, the relative access to decision-making was not shared among all of the women within a household. The nature of polygamous households and extended families in Mali creates a hierarchy of power among women. A first wife generally retains the majority of control, with subsequent wives' control declining. Elderly woman in the household are respected and admired by both men and women in the family, and enjoy a certain degree of seniority in the family. Being an outsider in the family hierarchy, a daughter-in-law often bears the greatest burden of the power relationships within the household. As a result, these women commonly must take on the greatest labor burden among women in the household (Castle, 1993).

Undoubtedly, women rely so greatly on men not only because of cultural norms and behaviors, but also because women have traditionally had limited access to capital, including property rights (Joireman, 2008). In the past, men have had greater access to education, economic opportunities, and participation in community organizations within the village. Having greater access to systems of local leadership, these individuals can develop authority among their peers and have the opportunity to gain respect in their community. The greater the capacity an individual has (in terms of literacy, assets, and labor), the fewer barriers to participation (Prokopy, 2009). Social stature and perceived access to capital (e.g., natural resources and social capital) are arguably the most powerful tool for a subsistence farmer in rural Mali. The opportunities for women are changing in Mali as men and women take on different roles in their communities. In the San area, development initiatives such as microcredit and community gardens are generating new opportunities for household members, particularly for women. The relative participation between men and women, however,

remains defined by traditional systems of organization and accepted roles in community management.

Committees and CBOs are another aspect of village organization traditionally segregated by gender. Men and women participate in village associations based on their individual household needs and the institutionalization of collective organization. Newer committees formed by NGOs are trying to incorporate a Western perception of gender equality into development initiatives. Although women are increasingly included in decision-making environments, the degree to which their participation is authentic is questionable. Unfortunately, gender-mainstreaming initiatives in global development programs often distill into symbolic gestures (Singh, 2007). The most common of these gestures being the inclusion of women on community-based organizations established by NGOs to manage new village capital or livelihood practices. The WATSAN committees examined in this study did little to empower women; in fact, it could be argued they further legitimized traditional gender roles and simply increased the workloads of women.

The implications of understanding gendered roles in local resource use and management are critical for effective collaborative development. Existing roles identify how men and women are currently contributing to local resource management. As development initiatives continue to be implemented in rural communities, the roles of water users will evolve along with changing technologies, practices, social capital, and available resources. As a dynamic system, the implications of development must adapt to the gender-specific needs and priorities of individual stakeholders.

8.1.2 Closing comments

This research project identified a number of challenges to improving water resource management through collaborative development projects. Decentralization efforts, combined with limited government resources, has resulted in reliance on foreign development agencies to provide many basic services for impoverished villages throughout rural Mali. Development collaborations, like WAWI, work with local governments, partner NGOs, and traditional village administrations to provide improved water infrastructure. As a component of all water projects, community water and sanitation committees are established by partner agencies to manage local water resources. Besides limited training, dwindling membership motivation, and poor community mobilization, these committees are ultimately constrained by traditional local authority.

Although gender-mainstreaming has raised the issue of inclusion and participation among women in rural communities engaged in water projects, the good intentions of gender-mainstreaming during WAWI's first phase of programming were seldom realized in rural communities. Gender-sensitive initiatives were rarely compatible with traditional systems of organization, perpetuating the marginalization of women and children in local resource management. These challenges make the goal of improved water resource management difficult, as the short-term ambitions of development agencies often conflict with the long-term needs of rural communities. Unfortunately, this is leaving many households in the *Cercle de San* with unsustainable water infrastructures.

There are, however, some positive signs of local collaborative development in the region. Some communities have organized themselves effectively, placing individuals with authority and motivation in positions to manage local water

resources on behalf of the collective good. While this still excludes women from traditional roles of authority, water infrastructure is better maintained. Additionally, existing authority and power of women within their households and as traditional women's collectives should not be discounted. Established systems of power among women must be better assessed by project partners to appropriately incorporate their participation in a manner acceptable to valued traditional systems of governance. The voice of marginalized stakeholders must be increasingly recognized in community development and consequently, resource management.

Additional projects coinciding with the construction and rehabilitation of water infrastructure are also providing new opportunities for both men and women. Community gardens established by WAWI partners have not only provided improved nutrition for households, but have also introduced new livelihood opportunities with smallholder trading, particularly for women. The mobility of men and women in these rural households results in a high level of awareness regarding various water resource practices and technologies. Traditional knowledge is an important resource, as is the transfer of new knowledge between households and communities. This particular analysis highlighted specific opportunities for development partners to improve agricultural and household water use in rural communities, including the use of rainwater harvesting. Social learning, however, does not always lead to behavior change. Community ownership of external practices and technologies must not only reflect local needs, but should also consider the cultural norms and behaviors that may facilitate partnership, even when they seem incompatible with external development agendas.

This research suggests that finding the balance between traditional systems of organization and Western perceptions of participatory development does not always function in the best interests of rural communities. Despite improved efforts by government and NGOs, participatory development falls short of empowering rural households and supporting improved resource management. Possibilities exist to better utilize existing systems of organization in collaborative water resource management, without disregarding the goals of gender equality and empowerment among marginalized populations.

While the discussion of specific challenges to water management through the implementation of development projects is important, there is a larger concern at play – the viability of sustainable water management in the Bani River basin, especially as the effects of climate change worsen. As introduced in Chapter 1, Mali has substantial per capita renewable water supplies given its location in arid sub-Saharan Africa (Earthtrends, 2003). What has been difficult to ascertain is how sustainable these water resources are as water extraction increases to meet the needs of growing populations, while at the same time, precipitation and river water flows continue to decrease.

In 2005, researchers from the Desert Research Institute in Nevada collected measurements on groundwater levels and modeled changes in subsurface water supplies under different climatic and population growth parameters. The findings indicated that an increase in population along the Bani basin would have a minimal effect on groundwater supplies, with the exception of concentrated extraction (e.g., urban water demand versus extraction by rural community hand pumps) (Lutz et al., 2009). However, the research also found that a devastating acute drought or even an extended period of low annual rain-

fall would have a detrimental effect on groundwater supplies in the Bani basin. Lutz et al. (2009) found that if average precipitation levels were reduced by 30% over five years, groundwater supplies would see a 6% decline. Natural water flows are being altered in the Bani basin by both human and environmental causes, a process that threatens local river ecosystems (Poff et al., 1997) and the communities within them. If water supplies throughout the region are not managed sustainably at the basin-level, the sustainability of smaller-scale water projects may be questionable.

8.2 Limitations and assumptions

There were a number of key assumptions in this research, as illustrated earlier in Table 1.2. It was assumed that for the most part, trust between the interviewer and participant could be established with individuals in the community through honesty, transparency, and thoughtful relationship-building. With this trust, it was also assumed that individuals within the community would provide open and honest viewpoints regarding their personal perceptions and experiences with development initiatives.

Communities have different vested interests in their growth and well-being, as do individuals within these communities. This study focuses on the experiences and perceptions of individuals within nine particular villages, and their stories are not necessarily representative of all villages in the region, let alone all households within their villages. Nonetheless, the findings from this analysis provides useful insight into the resource management process from the view of local participants, but in the larger context of rural development.

Like the individuals in a community, women in Mali are not a homogeneous social class. As a gerontocratic society, women in Mali have increased social status as they age, which is strengthened by marriage and her progeny (Grosz-Ngaté, 1989). Varying degrees of economic wealth and social standing influence their relative power, not only in the community, but among their immediate peers (Cunningham, 2009; Lockridge, 2006). While exploring the differences in resource use, these in-group stratifications were taken into account. In addition to the acknowledgement of social status, it was assumed that women do not have a significant amount of time available for individual or group discussions. The methodological tools used in this study were selected to provide effective data collection given this important consideration.

Upon reflection of the overall research process and data, this study would have benefited from involving more households in the sample to ascertain the statistical correlations between various elements of the research. While the current data provide a substantial overview of community-based water management in the context of rural development and diverse partnerships, there were limitations in the detailed analyses. An example of more in-depth analysis includes determining the potential links between perceived responsibility of pump repairs and relative household security as demonstrated by education, occupation and livestock holdings. Despite these limitations, the data do reveal discernible patterns and compelling insight into the complex relationships, perceptions, and experiences among stakeholders involved in WAWI. As WAWI activities continue to progress and evolve in the *Cercle de San*, further research among these particular households, such as the impacts of water projects on food security and technology adoption, would add to our understanding of local resource management influenced by development interventions.

8.3 Research impact

The research examined a number of important components of community-based natural resource management using practical, contextual examples of community participation in World Vision Mali Rural Water Project (MRWP) programming around San.

The study presented in these chapters is relevant for three reasons. First, the West Africa Water Initiative (WAWI), as implemented by the MRWP, has relatively large impact. The population of the three Area Development Programs (ADPs) in this study alone is nearly 190,000. As of late-2010, World Vision had 30 ADPs. Many of the ADPs had received either improved water access, newly constructed latrines, or hygiene and sanitation sensitizations. Partnerships like WAWI, have the potential to drastically improve the quality of life for rural households throughout West Africa. The development projects can and are often relied upon to fill the void when governments are unable to provide basic social services to their populations.

Second, the methodological approach developed in this research provided a unique framework for examining international development in terms of an integrated system intended to improve rural livelihoods. Grouping the research in waves allowed for relationship building, the ability to follow-up with interviews in otherwise logistically challenging settings, and the coordination of research around rainy season farming activities. Gaining insight into the personal experiences of households with water projects and local water resource management was best facilitated by a range of data collection techniques. While focusing on individual households, consideration of other stakeholders, such as

government and NGOs, was a practical way to understand the impacts of development initiatives on rural communities from a resource management perspective. This idea, however, is inevitably linked to a vast range of needs and expectations by diverse stakeholders. As a system, the perceptions of stakeholders and the institutions in place to influence behaviors in development processes can be better understood by delineating the complex relationships. The voice of the recipients of development projects is perhaps most significant, as it identifies the practical realities of project impacts. The personal experiences and perspectives of individuals can then be put into context by understanding the environment in which they evolve.

Third, by examining improved resource management in the context of water projects, a fundamental need of rural populations was targeted – access to clean, sustainable water supplies. For much of the study area, 60 to 70% of pumps were nonfunctional. In a *commune* with a population of 10,000 or more, this had a significant impact on households lacking safe water and struggling between each rainy season when wells became dry and the rivers receded. Additionally, the examination of communities participating in improved water management projects portrayed a system of development that was both ineffective and unsustainable. The failure of such a large proportion of physical infrastructure and organized community management efforts overshadows those projects that have worked for rural households by creating negative perceptions of collaborative development within communities, which were intended to manage local resources.

The arguments described above support the research approach employed to examine community-based resource management among rural communities

in the *Cercle de San* in the context of development projects. The following sections take this discussion further by reflecting on how the use of a structural and behavioral analysis deepens insight into future research and practice of community-based water resource management.

8.4 Implications for future research

Framed by the dimensions of collaboration, gender, participation, social capital, and social learning, the structural details of the WAWI partnership in the *Cercle de San* and the perceptions and use of opportunities among participants in WAWI projects explored by this research provide a novel base of knowledge for the analysis of water projects in water-scare settings throughout Africa. This research stands as an entry point for examining structural and behavioral mechanisms together more thoroughly in the context of rural development initiatives. The findings discussed in this research identify two core gaps in knowledge that would benefit from further research, including: 1) how to situate gender-mainstreaming initiatives into the context of traditional norms and behavior to increase the authentic participation of women in community resource management, and 2) how to use social capital to emphasize the relationships between water user and resource rather than solely water resource availability, to increase participation among stakeholders more generally.

The first knowledge gap refers specifically to the disparate perceptions of gender roles and participation in water projects between development practitioners and members of households in rural Mali. This research has identified that a disconnect exists, limiting the empowerment of women in rural commu-

nities by perpetuating environments where women are excluded from collaborative development processes despite the intention to promote active participation. Traditional gender roles are often thought as the root cause of poor participation among women and one of the immediate solutions has been to force participation in newly formed CBOs (e.g., stipulating half of committee membership should be held by women). However, in many contexts, traditional gender roles should not be considered detrimental to the inclusion of women in participatory development, but used to identify behavioral mechanisms, or opportunities, for women to contribute to improved water resource management. Gender-mainstreaming will continue to be a symbolic gesture unless the traditional systems of organization are recognized and accepted by development partners. The second gap in knowledge follows up on this challenge by suggesting that existing systems of organization among men and women are important structural mechanisms to empower marginalized water users in local resource management, and more generally in community development. This has particular significance for women in rural communities, who are especially excluded from decision-making environments, despite their intimate use of local resources for household survival.

It is clear that there are institutionalized systems of traditional organization in rural communities, but it is unclear how development agencies may better coordinate with these systems of organization in development initiatives. Traditional community-based organizations (CBOs) often involve a wide range of individuals who are independent of traditional village leadership. When development initiatives collaborate directly with traditional leadership or institute new CBOs based on membership determined by the village chief, a significant proportion of the community becomes excluded from what is intended

to be participatory development. Of course, a strong partnership with traditional leadership at the onset of any project is essential to respect traditional authority, but expanding relationships to members of traditional CBOs has the potential to engage local participation to a deeper level. The question is how to do so without undermining the essential relationships with traditional village leadership and without creating new barriers to marginalized water users. Understanding how structural and behavioral mechanisms function in local water resource management in unique local contexts remains a strong tool to explore these issues. As these gaps in knowledge are better understood, related concepts in development, such as social learning (the use of traditional knowledge and the adoption of innovations) and collaboration (improved coordination of all stakeholders in resource management), will play equally important roles as development projects continue to be used to assist rural communities in local water resource management.

8.5 Implications for future practice

The primary objectives of WAWI were to increase access to water, reduce the occurrence of waterborne diseases, improve sustainable management of water resources, and develop models of partnership and institutional synergy. Lacking a baseline study, the partnership implemented a mid-term evaluation to examine progress relative to initial objectives and defined indicators (ARD/USAID, 2007). Partners evaluated tangible measures to quantify their impact across Mali, Ghana, and Niger, including the number of boreholes installed, wells rehabilitated, latrines constructed, and individuals trained in rural communities.

The challenge of such an evaluation was to capture a measurable degree of success or failure for future monitoring and evaluation. This was a useful tool for the participating funding agencies to direct future grants and for partners to adjust development approaches as the project evolved. However, projects are not just made of quantitative measures. Projects are equally defined qualitatively, reflecting personal experiences and perceptions of diverse groups of stakeholders.

Rural development does not occur in a vacuum. There are a diverse range of factors contributing to a project's success or failure – the approaches used by government and NGOs, the policies in place to guide projects to improve the use and management of local resources, the systems of organization that engage stakeholders, and the degrees of participation among both men and women – all of which act as a system of community development.

The analysis suggested that there are certain techniques and technologies that may be relevant to current development interventions, impacting local water resource management in the region. Technologies such as roof catchment may supplement current projects during the rainy season, to provide additional water resources during drier months for activities such as community gardening. The use of farmers' juries in rural Mali has also been positively received by men and women to contribute to the policy debate surrounding national agriculture and development (Sissoko, 2010). This may be a useful tool at local levels to engage more people from local communities in the design of the communal development plans (PDESC) alongside local government and NGOs.

Education is another aspect of community development that has a much greater effect on community-based resource management than can be measured

at this time. It would be insightful to assess how increases in adult literacy influences the role of men and women in community decision-making. Women and marginalized men will have new opportunities to participate in local organization, including those facilitated by development interventions, such as water and sanitation committees.

As subsistence farmers, households in the study villages faced tremendous daily stresses. The majority of household security is determined by the relative success or failure of a crop season. As a result, households learned to prioritize. Involving men and women in the process of local water management will gradually draw them into participatory systems of collaborative resource management. These processes continue to evolve as institutional forces, such as decentralization, control many of the opportunities for local development.

Smaller villages like Niamana-Masoumana may have an advantage over larger communities like Somo or Ténéni in community-based resource management efforts through the process of rural development. The residents in this village were a cohesive unit working together through difficult conditions. There was a great deal of trust among one another and community organization was strong and revered. Households had a clear understanding of community and collaborative development projects with partner NGOs and the government. Effective organization had allowed the community to respond more timely to challenges, such as repairing water infrastructure, so that sustained impacts on the households were limited. The positive, cyclic nature of these relationships and experiences had allowed human capital to grow in the village. Although this is just one example of how community and development partners had embraced traditional systems of organization together with new ideas and tech-

nologies to succeed at collaborative water resource management, it is worth a final reflection.

APPENDIX A

DEFINITIONS [WATER POINTS]

Water points were defined as any source of water for individual or household use. For the purpose of this research, the following distinctions are made below.

Traditional wells: Wells that are hand-dug, typically to a depth of 7-12 meters in the San area. These can be found in private households, places of business and community gardens.

Private or traditional household wells: Traditional wells that are found inside or very close to household compounds for private use by the residents within the compound and in some cases, extended families or neighbors without their own immediate water source.

Public traditional wells: Hand-dug wells found throughout the village in alleyways and gathering spaces for the use of local residents. Some of these wells are over 100 years old and vary widely in quality because of contamination from animals, humans and environmental debris.

Rehabilitated wells: Any traditional well where drainage has been improved to prevent debris entering the well. A concrete barrier is often placed around the well opening in addition to a secure covering. Users are advised to keep their bucket hung above ground to keep it free of debris and contamination when not in use.

Modern wells: A large-diameter well mechanically bored and cased with concrete. At the surface, the well is typically surrounded by a protective concrete barrier and steel lid. Water is collected using an attached chain/rope and bucket winch system or users bring their own rope and bucket to fetch water, allowing multiple users to access the water point at the same time. Modern wells are usually installed by the government or an NGO. They are referred to as *puits á grand diametre* in Mali.

Boreholes: Small diameter hole drilled deep into the sub-surface beyond a shallow aquifer. Boreholes are believed to provide a safe, sustainable source of water protected from run-off or cross-contamination, although it is possible for a borehole to become contaminated in the drilling process or contain water that has naturally-occurring contaminants such as heavy metals or high salinity. Some NGOs and governments now ensure boreholes are tested prior to completing. If water tests indicate a safe water source, the borehole is completed with a pump. Pumps are often hand (India-Mark II) or foot pumps. Solar pumps are also used in parts of Mali, although are much less common due to cost and frequency of theft.

Water tower/tap system: Generally found in urban centers, water towers provide a source of water for larger populations through a piped tap system. A standpipe is provided in the household compound which are sometimes plumbed into a indoor tap system, when economically viable. Solar pumps may also be used to move water more efficiently, however are costly and have been subject to theft in the region.

APPENDIX B

VILLAGE LOCATIONS

Village	Latitude	Longitude
Ténéni	N13°19'54.6”	W004°48'47.6”
Daelan-Sobala	N13°15'58.9”	W005°00'14.3”
Somo	N13°14'27.1”	W004°46'40.7”
Diakourouna-Nirisso	N12°52'00.0”	W005°07'60.0”
Niamana-Masoumana	N13°02'78.8”	W005°13'33.7”
Tiomporosso	N13°06'28.9”	W005°09'36.3”
Paparoné	N13°30'52.4”	W004°39'00.0”
Bankouma-Bobo	N13°27'52.6”	W004°35'07.0”
Pona	N13°29'00.0”	W004°42'00.0”

APPENDIX C

INTERVIEWS

Key Informant A
(Government, WAWI-WV)

1. Background/ Development Ideologies
   1.1. How has your organization worked on water resource management in the region over the past 20 years?
   1.2. How long have you been working with this organization?
   1.3. What specific types of development programs do you work with in the San region to improve water resource management?
   1.4. Who are the stakeholders involved (government, NGOs, village committees, etc)?
   1.5. What is your role with these communities to support local water resource management (methods/ approaches)?
   1.6. How would you describe your relationship with local communities (provide resources – what types, communication---how regularly?)
   1.7. Do you feel as though local committees are effective in realizing local water management goals, including national policy targets? What might make them more effective?

2. Intervention in Communities
   2.1. Can you give me examples of current development initiatives with international agencies in water management that are effective in the region, including the villages of _____?
   2.2. Can you give me examples of current development initiatives with international agencies in water management that have caused problems in the region, including the villages of _____?
   2.3. Based on your experiences, what do you think makes a water resource management project work successfully? Probe for:
      2.3.1. types of organizations involved and how?
      2.3.2. planning and management by who (by government, the communities, international or Malian NGOs)?
      2.3.3. participation from community, community-based organizations and how?
      2.3.4. involvement from men/women?
      2.3.5. certain technologies?
      2.3.6. rules for resource use?
      2.3.7. funding from who?
      2.3.8. other?

3. Unintended Consequences of Intervention Design
   3.1. How do you see communities using other local resources differently in communities with improved water sources? Explain.
   3.2. How do you feel as though these water projects change the villages in other ways? (Probe: social relationships, access to more opportunities economically/socially, conflict, other)

4. Gender Roles in Water Resource Management
   4.1. Can you explain the roles of both men and women in local water management?
   4.2. Can you explain how the inclusion of women in village-level decision-making changes local water management?

Key Informant B
(Chief, Mayor, Village Council)

1. Water Inventory (ask to walk around and view the water sources, if accessible).
   1.1. Can you tell me about the history of water resources in your community?
      1.1.1. What types/locations?
      1.1.2. What is the quality of each source?
      1.1.3. Is it always available? (Probe: seasonal drying, broken at any time)
      1.1.4. Are there alternative sources of water if needed?
      1.1.5. Who made the decisions on where the new water source was placed?
      1.1.6. Who collects water for household?
      1.1.7. When and how many times each day?
      1.1.8. From which sources each time (Probe: how is does this change during different seasons)?
      1.1.9. How long does it take each day?
      1.1.10. How is this different than before the new water source (Probe: improvements during seasons of limited/poor water)?
      1.1.11. Main uses of water?
      1.1.12. Have you had problems with your water sources?
      1.1.13. How do you resolve the problems (i.e. who do you talk to?)

2. Intervention in Community
   2.1. Who has worked in your community to improve the water?
      2.1.1. Government, NGOs, Community groups, individuals, no help?
      2.1.2. What were their roles?
      2.1.3. Did these projects work or not?
      2.1.4. Why? (Probe: community involvement including individuals and CBOs, intervener relationship/ presence/duration, support of government, environmental reasons)
3. Changes in Resource Use/ Social Networks (Probe: These questions are in 3 parts – DRY season, RAINY season, and HOW)
   3.1. How has the new water source changed your lives compared to before?
      3.1.1. Changed the time spent collecting water?
      3.1.2. Changed your uses of water? (Probe: collect more/less, use it for other purposes)
      3.1.3. Changed the time used for other economic activities? Please explain. (Probe: crop production, livestock, smallholder activities, other)
      3.1.4. Changed the time to visit with others in community? Please explain. (Probe: opportunities to hear village news, courtships, other)
      3.1.5. Affected the health of members of the village? (Probe: Pollution/contamination from water source or from increases in other resource uses/economic activities)
      3.1.6. Created or reduced conflict in community? How?

4. Gendered Roles in Water Resource Management
   4.1. What are roles for both men and women in water management in this village? Explain.
      4.1.1. What are the responsibilities of women and what are the responsibilities of men in local committees such as WATSAN and repair/maintenance committees? (Probe: are these roles gendered)
      4.1.2. How are decisions on water made for the entire village?
      4.1.3. How are household decisions made on water use?

WATSAN Committee Member

1. Demographics
   1.1. Basic demographics

Gender	Age	Position on WATSAN	Duration member of WATSAN

1.2. Education

Code	Education level of Respondent	Response (X)
1	None	
2	Non-formal	
3	Basic 1st cycle	
4	Basic 2nd cycle	
5	Secondary	
6	Higher ed (college/university)	
7	Vocational	
8	Arabic	
9	Military	

1.3. Occupation (formal or informal)

Code	Primary occupation	Response (X)
1	Crop production	
2	Livestock/breeding	
3	Ag production (crop and livestock)	
4	Smallholder vegetable production	
5	Artisan/tailor	
6	Mason/builder	
7	Mechanic	
8	Small trade	

Code	Primary occupation	Response (X)
9	Hired laborer (informal)	
10	Salaried employee (formal)	
11	Household	
12	Carpentry	
13	Fishing	
14	Other_____	
0	N/A	

Code	Secondary occupation	Response (X)
1	Crop production	
2	Livestock/breeding	
3	Ag production (crop and livestock)	
4	Smallholder vegetable production	
5	Artisan/tailor	
6	Mason/builder	
7	Mechanic	
8	Small trade	
9	Hired laborer (informal)	
10	Salaried employee (formal)	
11	Household	
12	Carpentry	
13	Fishing	
14	Other_____	
0	N/A	

1.4. Community labor contribution

Code	Primary community labor contribution	Response (X)
1	Quartier activities	

Code	Primary community labor contribution	Response (X)
2	Community garden	
3	Cereal bank	
4	Microcredit	
5	Plant/harvest collective farm	
6	School association	
7	Men's association	
8	Women's association	
9	Youth association	
10	Health volunteer	
11	Cotton growers association	
0	N/A	

2. Water Inventory

Can you tell me about the history of water resources in your community?

a. What types/locations?
b. What is the quality of each source?
c. Is it always available? (Probe: seasonal drying, broken at any time)
d. Are there alternative sources of water if needed?
e. Who made the decisions on where the new water source was placed?
f. Who collects water for household?
g. When and how many times each day?
h. From which sources each time (Probe: how is does this change during different seasons)?
i. How long does it take each day?
j. How is this different than before the new water source (Probe: improvements during seasons of limited/poor water)?
k. Main uses of water?
l. Have you had problems with your water sources?
m. How do you resolve the problems (i.e. who do you talk to?)

3. Intervention in Community

Who has worked in your community to improve the water?

a. Government, NGOs, Community groups, individuals, no help?
b. What were their roles?
c. Did these projects work or not?
d. Why? (Probe: community involvement including individuals and CBOs, intervener relationship/presence/duration, support of government, environmental reasons)

4. Changes in Resource Use/ Social Networks (Probe: These questions are in 3 parts – dry season, rainy season, and how)

How has the new water source changed your lives compared to before?

a. Changed the time spent collecting water?
b. Changed your uses of water? (Probe: collect more/less, use it for other purposes)
c. Changed the time used for other economic activities? Please explain. (Probe: crop production, livestock, smallholder activities, other)
d. Changed the time to visit with others in community? Please explain. (Probe: opportunities to hear village news, courtships, other)
e. Affected the health of members of the village? (Probe: Pollution/contamination from water source or from increases in other resource uses/economic activities)
f. Created or reduced conflict in community? How?

5. Gendered Roles in Water Resource Management

What are the roles for both men and women in water management in this village? Explain.

a. What are the responsibilities of women and what are the responsibilities of men in local committees such as WATSAN and repair/maintenance committees? (Probe: are these roles gendered)
b. How do you feel about the level of cooperation among the committee? (Probe: gendered involvement on input/decisions, levels of trust)
c. How are decisions on water made for the entire village?
d. How are household decisions made on water use?
e. How are decisions made on water use for your economic activities?

Focus Group Sessions
(water users in community)

Village:_____
ADP:_____
Date of Interview:_____
Place of interview:_____

Gender of Participants:_____
Number of participants at start:_____
Number of participants at end:_____
Start Time:_____
End Time:_____

1. What does water resource management in your village mean to you? (Show pictures)
2. Can you give some examples of positive experiences with water projects in your village? (Probe: why successful)
3. Can you give some examples of negative experiences with water projects in your village? (Probe: why unsuccessful)
4. Who benefits from water projects? (Probe: How do some benefit more than others?)
5. What would you change about water projects in your community?
6. How are local committees helpful in managing the resources in the village?
7. How important is a local committee's heterogeneity (in terms of gender, age, wealth, and status in the community)?
8. Do you wish to be included more in decisions on local natural resource management, including for water?
9. Which roles should be given to women and which should be given to men in any type of local resource management?
10. How have water projects changed your daily lives? (Probe: Good and bad experiences with resource use and social networks)

Water Resource User Interviews
(Household Surveys)

Name:_____ Date of Interview:_____
Village:_____ Start Time:_____
ADP:_____ End Time:_____

PART I

1. Water Inventory (Ask to walk around and view the water sources, if accessible).

Can you tell me about the history of water resources in your community?

a. What types/locations?
b. What is the quality of each source?
c. Is it always available? (Probe: seasonal drying, broken at any time)
d. Are there alternative sources of water if needed?
e. Who made the decisions on where the new water source was placed?
f. Who collects water for household?
g. When and how many times each day?
h. From which sources each time? (Probe: how is does this change during different seasons)
i. How long does it take each day?
j. How is this different than before the new water source? (Probe: improvements during seasons of limited/poor water)
k. Main uses of water? (Probe: how does this change in dry and rainy seasons)
l. Have you had problems with your water sources?
m. How do you resolve the problems? (i.e. who do you talk to?)

2. Intervention in Community

Who has worked in your community to improve the water?

a. Government, NGOs, Community groups, individuals, no help?
b. What were their roles?
c. Did these projects work or not?
d. Why? (Probe: community involvement including individuals and CBOs, intervener relationship/presence/duration, support of government, environmental reasons)

3. Changes in Resource Use/ Social Networks (Probe: These questions are in 3 parts – DRY season, RAINY season, and HOW)

How has the new water source changed your lives compared to before?

a. How has it changed the time spent collecting water? (Probe: Seasonal issues)
b. How has it changed your uses of water? (Probe: collect more/less, use it for other purposes, seasonal changes)
c. How has it changed the time used for other economic activities? Please explain. (Probe:

crop production, livestock, smallholder activities, consider seasonal opportunities)
d. How has it changed the time to visit with others in community? Please explain. (Probe: opportunities to hear village news, courtships, participate in community organizations, other)
e. Affected the health of members of the village? (Probe: Pollution/contamination from water source or from increases in other resource uses/economic activities)
f. Created or reduced conflict in community? How?

4. Gendered Roles in Water Resource Management

What are the roles for both men and women in water management in this village? Explain.
a.What are the responsibilities of women and what are the responsibilities of men in local committees such as WATSAN and repair/maintenance committees? (Probe: are these roles gendered)
b. How are decisions on water made for the entire village?
c. How are household decisions made on water use?
d. How are decisions made on water use for your economic activities?

PART II

****indicate the response or provide written details where appropriate****

A. Household Demographics

1. Respondent: (1) Female (0) Male
a. are you the head of HH? (1) Yes (0) No
b. is HHH male or female? (1) Female (0) Male
c. Respondent role in HH

Code	Role/position in household	Response (X)
1	Father/husband	
2	Mother/wife	
3	Son	
4	Daughter	
5	Other relative	
6	Other (explain)_____	

d. Name of village/quartier committee (active membership)_____

e. Education level

Code	Household religion	Response (X)
1	None	
2	Non-formal	
3	Basic 1st cycle	
4	Basic 2nd cycle	
5	Secondary	
6	Higher ed (college/university)	
7	Vocational	
8	Arabic	
9	Military	

f. Religion in HH by observation if inappropriate to ask

Code	Household religion	Response (X)
1	Islam	
2	Christian	
3	Animist	
4	None	

2. What is the current total number of your household members?
   a. Total in HH _____
   b. Total residing in HH _____
   c. Age groups of members residing in HH:

# in HH <15	# in HH 15-29	# in HH 30-59	# in HH ≥60

3. If head of household not interviewed (HHH), please fill out the following information:
   a. Age of HHH _____
   b. Education level

Code	Education level of HHH	Response (X)
1	None	

Code	Education level of HHH	Response (X)
2	Non-formal	
3	Basic 1st cycle	
4	Basic 2nd cycle	
5	Secondary	
6	Higher ed (college/university)	
7	Vocational	
8	Arabic	
9	Military	

c. Primary occupation

Code	Primary occupation	Response (X)
1	Crop production	
2	Livestock/breeding	
3	Ag production (crop and livestock)	
4	Smallholder vegetable production	
5	Artisan/tailor	
6	Mason/builder	
7	Mechanic	
8	Small trade	
9	Hired laborer (informal)	
10	Salaried employee (formal)	
11	Household	
12	Carpentry	
13	Fishing	
14	Other_____	
0	N/A	

d. Secondary occupation

Code	Secondary occupation	Response (X)
1	Crop production	
2	Livestock/breeding	
3	Ag production (crop and livestock)	
4	Smallholder vegetable production	
5	Artisan/tailor	
6	Mason/builder	
7	Mechanic	
8	Small trade	
9	Hired laborer (informal)	
10	Salaried employee (formal)	
11	Household	
12	Carpentry	
13	Fishing	
14	Other_____	
0	N/A	

e. What do you consider your primary community labor contribution?

Code	Primary community labor contribution	Response (X)
1	Quartier activities	
2	Community garden	
3	Cereal bank	
4	Microcredit	
5	Plant/harvest collective farm	
6	School association	
7	Men's association	
8	Women's association	
9	Youth association	
10	Health volunteer	
11	Cotton growers association	

Code	Primary community labor contribution	Response (X)
0	N/A	

4. If HHH interviewed or 1st wife not interviewed, please fill out the following details for the first wife:
   a. Age of first wife _____
   b. Education level

Code	Education level of HHH	Response (X)
1	None	
2	Non-formal	
3	Basic 1st cycle	
4	Basic 2nd cycle	
5	Secondary	
6	Higher ed (college/university)	
7	Vocational	
8	Arabic	
9	Military	

   c. Primary occupation

Code	Primary occupation	Response (X)
1	Crop production	
2	Livestock/breeding	
3	Ag production (crop and livestock)	
4	Smallholder vegetable production	
5	Artisan/tailor	
6	Mason/builder	
7	Mechanic	
8	Small trade	
9	Hired laborer (informal)	
10	Salaried employee (formal)	
11	Household	
12	Carpentry	

Code	Primary occupation	Response (X)
13	Fishing	
14	Other_____	
0	N/A	

d. Secondary occupation

Code	Primary occupation	Response (X)
1	Crop production	
2	Livestock/breeding	
3	Ag production (crop and livestock)	
4	Smallholder vegetable production	
5	Artisan/tailor	
6	Mason/builder	
7	Mechanic	
8	Small trade	
9	Hired laborer (informal)	
10	Salaried employee (formal)	
11	Household	
12	Carpentry	
13	Fishing	
14	Other_____	
0	N/A	

e. What do you consider your primary community labor contribution?

Code	Primary community labor contribution	Response (X)
1	Quartier activities	
2	Community garden	
3	Cereal bank	
4	Microcredit	
5	Plant/harvest collective farm	
6	School association	

Code	Primary community labor contribution	Response (X)
7	Men's association	
8	Women's association	
9	Youth association	
10	Health volunteer	
11	Cotton growers association	
0	N/A	

5. How many reside in the HH?
   a. # of daughter-in-laws_____
   b. # of husband's brothers_____
   c. # of husband's brother's wives_____
   d. # HHH/wives parents or grandparents_____
   e. # children_____

# Females <7	# Females 7-14	# Males <7	# Males 7-14

6. Education levels within HH

# females ≤14 some education	# females ≤14 with informal education	# adult females some education	# adult females with informal education	# males ≤14 some education	# males ≤14 with informal education	# adult males some education	# adult males with informal education

We would now like to ask you questions about the land or livestock your household owns.

7. What is the total size of your land?

Land Type	Ha
Permanent	
Rented/borrowed	
Communal	
Other_____	

Land Type	Ha
Total in this village	
Total farmed outside village	
Total land farmed separately by wife/wives	
Total land in HH (include separate land managed by wife/ wives if any)	

8. Please describe your land.

Parcel No.	Size (Ha)	Years since acquired in family	Mode of acquisition (1) inherited (2) bought (3) given by someone in village/assigned by chief (4) borrowed (5) claimed by him/herself (6) given by government agent (7) through marriage (0) no response	Status (1) mainly cultivated (2) mainly fallow (3) mainly natural/pasture (4) rented/lent out (0) no response	Have title or deed (1) Yes (0) No

9. Of this land, do you have a private garden? (1) Yes (0) No
   a. Size (Ha)_____
   b. What did you grow this past/current season?_____

10. Do you or your wife/wives have land in a community garden?

	Plot in community garden (1) Yes (0) No	**Size of Plot** (indicate m^2 or Ha)	**What was grown this past/current season?**	**Explain/Comment** (if necessary)
Husband				
Wife/wives				
Shared (husband/ wives)				
Other_____				

11. Please describe the livestock your HH owns or keeps.

Type	**# HH owns**	**# HH keeps**	**Has the overall number of these animals changed over the past 5 years**
Cattle			(0) decreased (1) increased (2) remained the same (3) both (4) we do not have animals
Sheep			
Goats			
Donkeys			
Oxen			
Chickens			Please explain why:
Guinea Fowl			
Horses			
Pigs			
Other_____			

12. In what ways is livestock/smallholder animal rearing is important to your HH?

Importance/use of livestock and smallholder animal rearing	**Rate in order of importance** (1=most important)	**Comments**
Source of income		
Security		
School fees		
Health expenses		

Importance/use of livestock and smallholder animal rearing	**Rate in order of importance** (1=most important)	**Comments**
Cultural/social activities		
Food/nutrition		
Organic manure		
Dry season planning		
Keep children busy/learn livelihood skills		
Paying taxes		
Other_____		

We would like to ask you a few questions about the crops you raised on your land in the past year.

13. Please describe your crop production last year.

Crop	**Grow** (1) Yes (0) No	**Area** (Ha)	**Fertilizer** (0) none (1) organic manure (2) chemical fertilizer (3) pesticides	**Secondary inputs** (0) none (1) organic manure (2) chemical fertilizer (3) pesticides	**Quantity produced** note units (kg/loft/bags)	**Quantity sold** note units (kg/loft/bags)	**Approximate sale** (0) N/A (1) all (2) half (3) less than half (4) none (5) don't know (6) all but small amount for seed/food	**Primary reason didn't sell** (0) HH consumption (1) flood/drought (2) illness (3) Seed for next year (4) Damaged (5) Make secondary product for market sale (6) Animal feed (7) Other_____ (8) N/A	**Water source** (1) Rain (0) Irrigation
Millet									
Rice									
Maize									
Sorghum									
Sesame									
Groundnuts									
Fonio									
Cotton									
Beans									
_____									

Do you have any additional comments about crop production/sale?	Has crop production changed over the past 5 years?	Please explain:
	(0) Decreased	
	(1) Increased	
	(2) Stayed the same	
	(3) Both increased and decreased	
	(4) No response	

14. Please describe your participation in local water resource management.

How often do you attend community meetings regarding local WRM?	How do you define participation in local WRM?	How would you rate local participation in WRM in your community?	How would you rate your and your family's participation in local WRM in your community?
(0) No response	(0) No response	(0) No response	(0) No response
(1) Very frequently	(1) Attending community meetings	(1) None	(1) None
(2) Frequently	(2) Speaking at meetings	(2) Excellent	(2) Excellent
(3) Occasionally	(3) Membership on committee	(3) Good	(3) Good
(4) Not at all	(4) Membership and speaking at committee gatherings	(4) Poor	(4) Poor
(5) Do not have	(5) Other_____	(5) Very Poor	(5) Very Poor
	(6) Do not wish to be included	(6) Don't know	(6) Don't know

6. Knowledge and Use of Water Management Practices

Water management practices/ innovations	**How frequently do you use this?** (0) No response (1) Very frequently (2) Frequently (3) Occasionally (4) Not at all (5) Don't have	**How do you rate your level of skill of this innovation (use)?** (0) None (1) Excellent (2) Good (3) Poor (4) Very poor (5) Don't know	**How do you rate your level of knowledge of this innovation (design/ understanding)?** (0) None (1) Excellent (2) Good (3) Poor (4) Very poor (5) Don't know	**How did you learn about this practice/ innovation?** (0) No response (1) On own/observe (2) Community group (3) Traditional knowledge (4) Family/friends (5) Non-formal training (6) Radio/TV (7) Don't know	**If you use this practice or innovation, from whom did you learn?** (0) No response (1) On own/observe (2) Family/friends (3) Farmer-to-farmer (4) Government extension (5) NGO/project (6) Community group/ leaders (7) Tradition (8) Visit/lived in different village (9) CSCOM/health center (10)Unknown 'project' (11)Other_____	**If it is a community practice or innovation, who started it?** (0) No response (1) Community members (2) NGO (3) Government (4) Tradition (5) Local health center (6) Unknown 'project' (7) Other_____
Hand dug well						
Protected hand dug well						
Modern well						
Foot pump						
Hand pump						
Treadle pump						
Water tower/ taps						
Stream/river protection						
Drainage ditches						
Roof catchment						
Drip irrigation						
Gardening						
Solar pumps						

7. Knowledge and Use of Other Community Practices

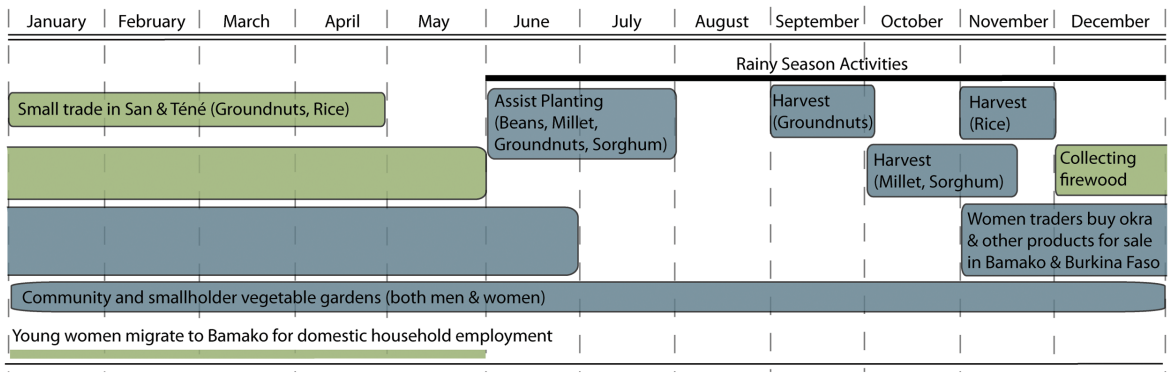
Water management practices/ innovations	**How frequently do you use this?** (0) No response (1) Very frequently (2) Frequently (3) Occasionally (4) Not at all (5) Don't have	**How do you rate your level of skill of this innovation (use)?** (0) None (1) Excellent (2) Good (3) Poor (4) Very poor (5) Don't know	**How do you rate your level of knowledge of this innovation (design/ understanding)?** (0) None (1) Excellent (2) Good (3) Poor (4) Very poor (5) Don't know	**How did you learn about this practice/ innovation?** (0) No response (1) On own/observe (2) Community group (3) Traditional knowledge (4) Family/friends (5) Non-formal training (6) Radio/TV (7) Don't know	**If you use this practice or innovation, from whom did you learn?** (0) No response (1) On own/observe (2) Family/friends (3) Farmer-to-farmer (4) Government extension (5) NGO/project (6) Community group/ leaders (7) Tradition (8) Visit/lived in different village (9) CSCOM/health center (10)Unknown 'project' (11)Other_____	**If it is a community practice or innovation, who started it?** (0) No response (1) Community members (2) NGO (3) Government (4) Tradition (5) Local health center (6) Unknown 'project' (7) Other_____
Cereal banks						
Microcredit						
Other_____						
Other_____						

APPENDIX D

ACTIVITY CALENDARS

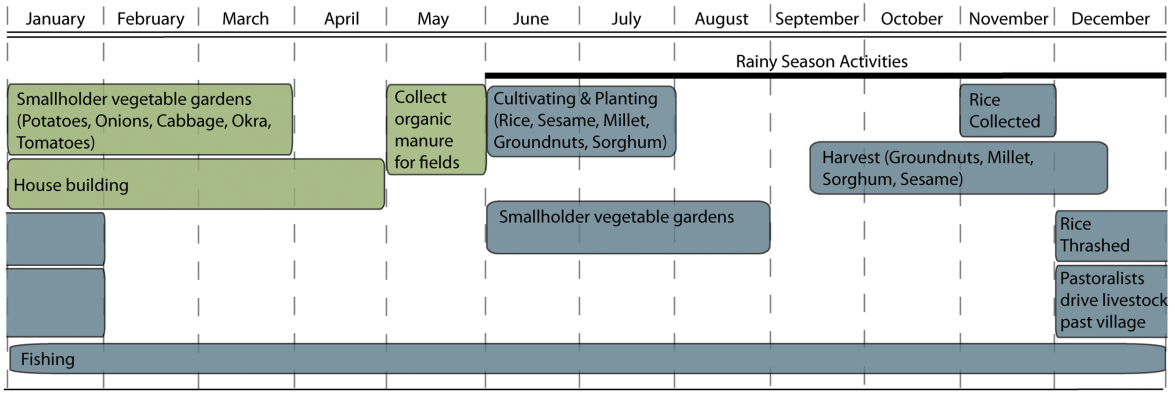
Ténéni
Female Focus Group

Activity Calendar
June 14, 2008



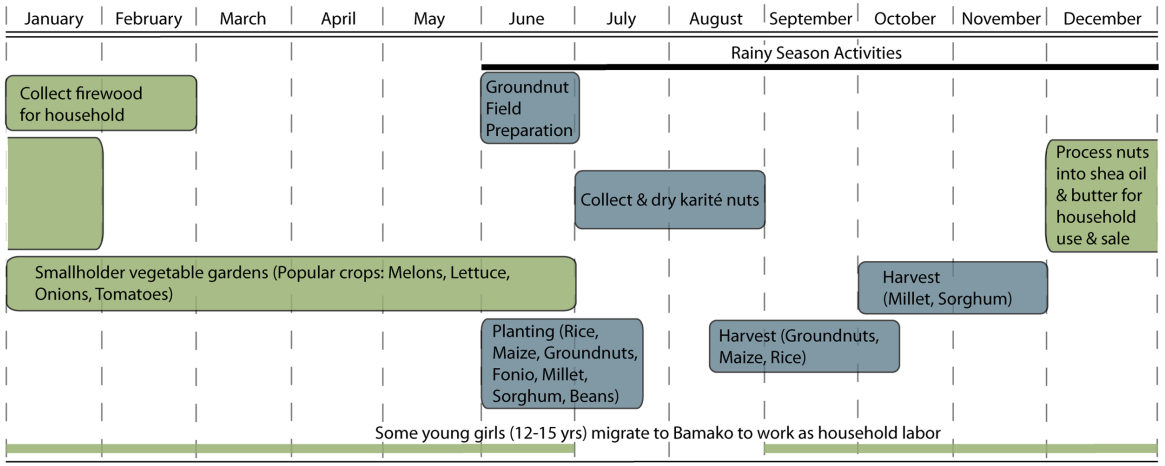
Ténéni
Male Focus Group

Activity Calendar
June 14, 2008



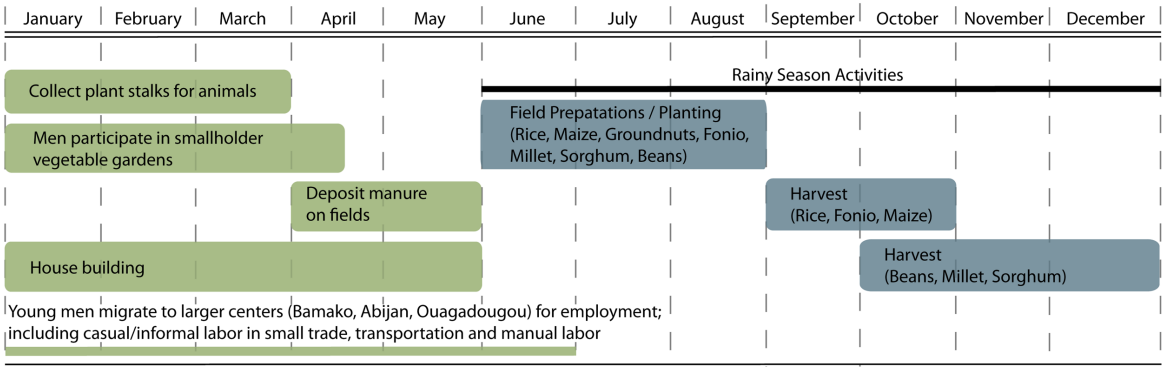
Daelan Sobala
Female Focus Group

Activity Calendar
June 18, 2008



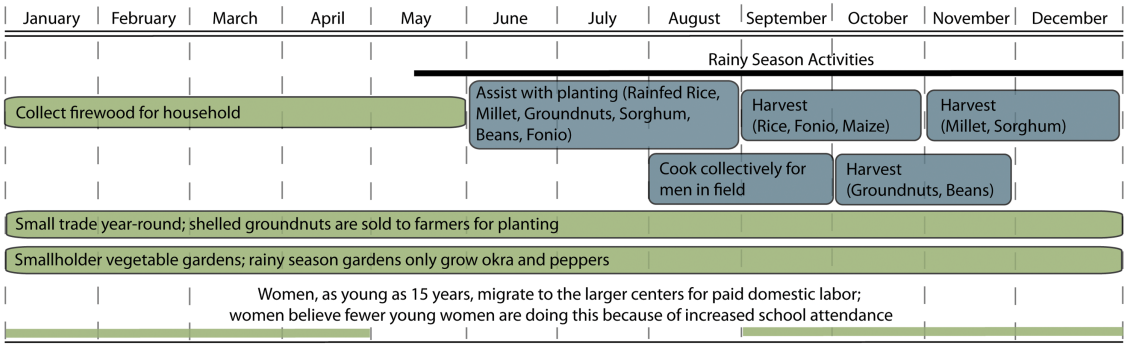
Daelan Sobala
Male Focus Group

Activity Calendar
June 18, 2008



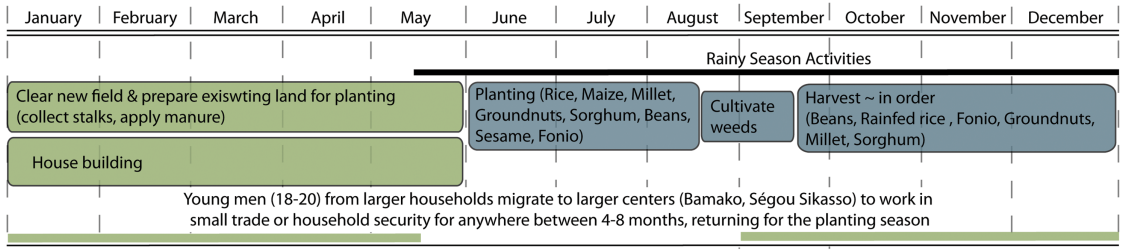
Somo
Female Focus Group

Activity Calendar
July 1, 2008



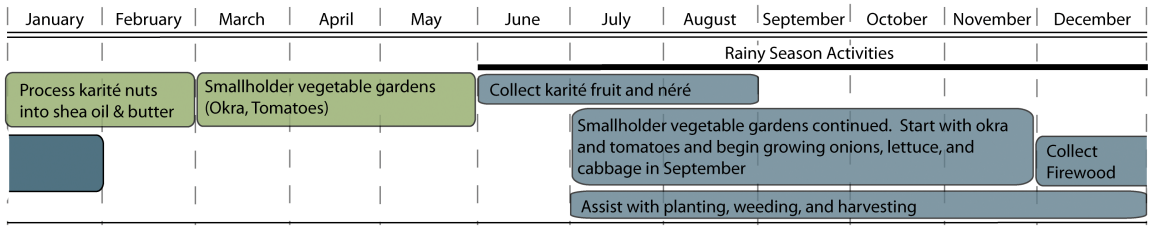
Somo
Male Focus Group

Activity Calendar
July 1, 2008



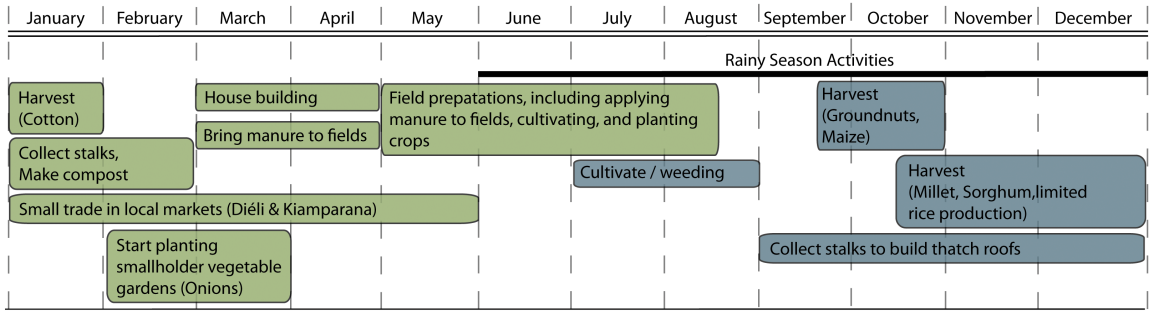
Diakourouna-Nirisso
Female Focus Group

Activity Calendar
June 9, 2008



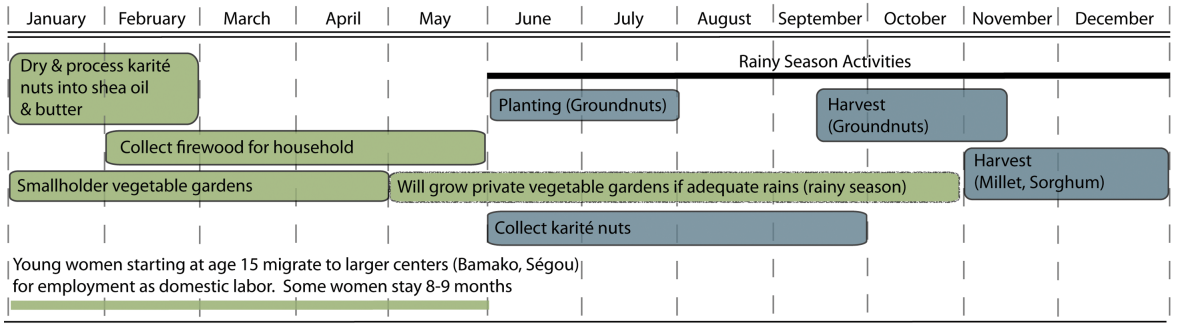
Diakourouna-Nirisso
Male Focus Group

Activity Calendar
June 9, 2008



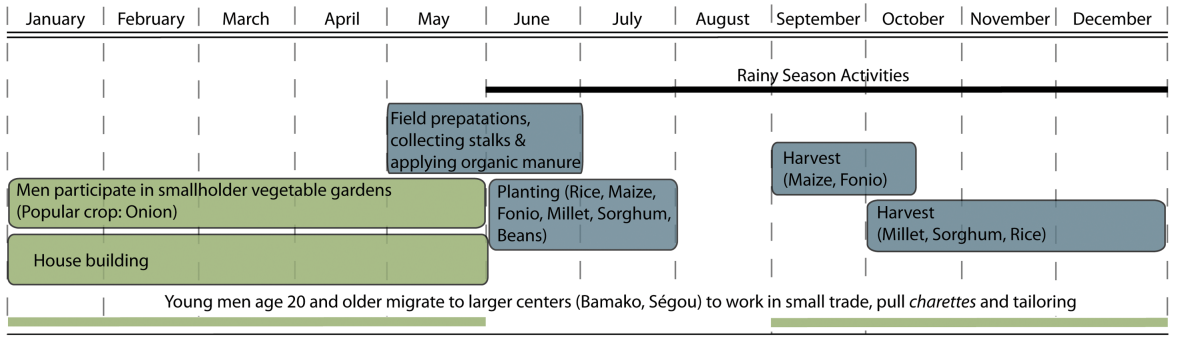
Tiomporosso
Female Focus Group

Activity Calendar
June 27, 2008



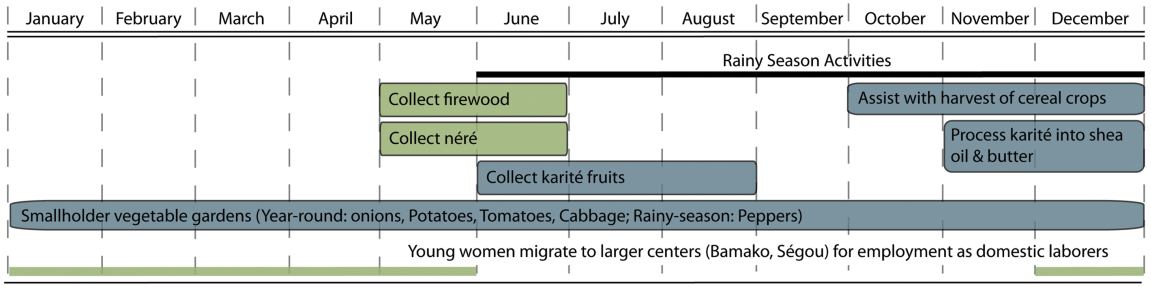
Tiomporosso
Male Focus Group

Activity Calendar
June 27, 2008



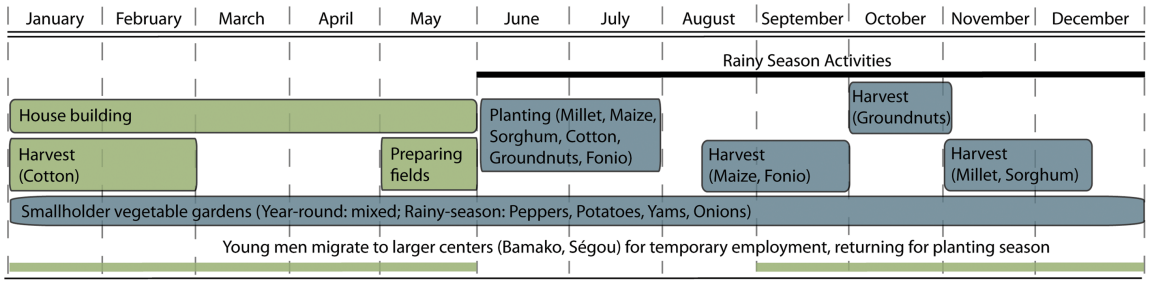
Niamana-Masoumana
Female Focus Group

Activity Calendar
June 15, 2008



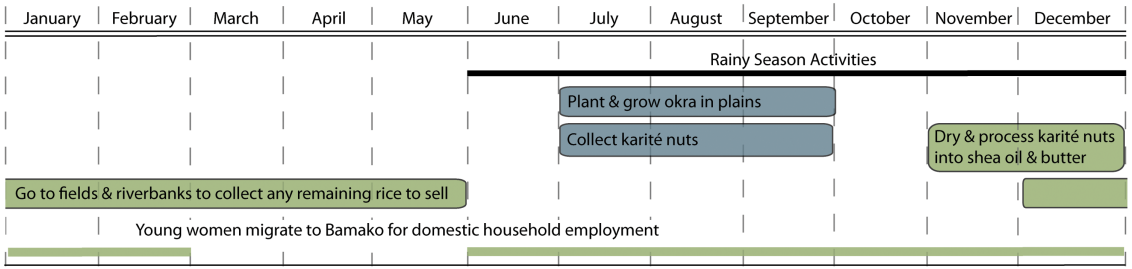
Niamana-Masoumana
Male Focus Group

Activity Calendar
June 15, 2008



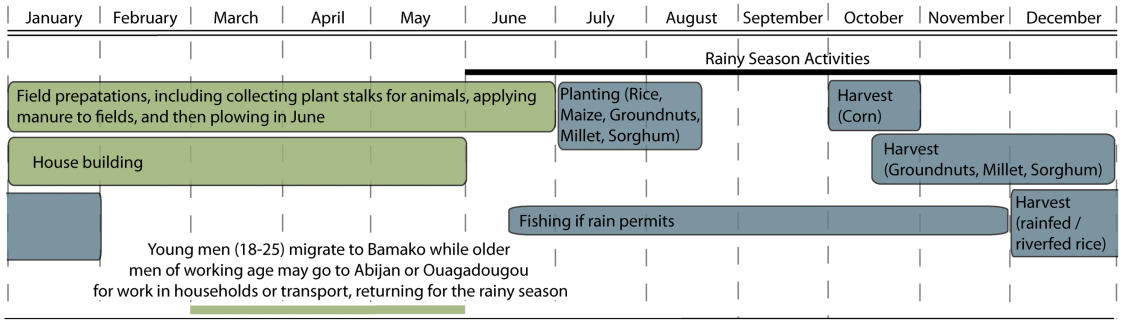
Paparoné
Female Focus Group

Activity Calendar
June 22, 2008



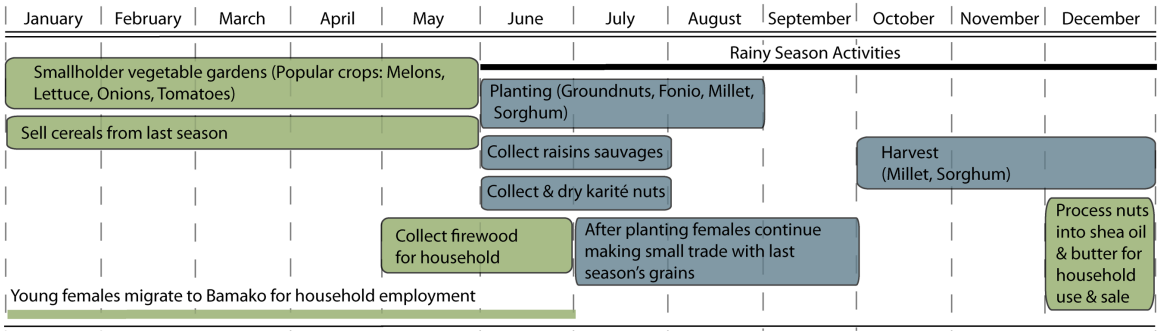
Paparoné
Male Focus Group

Activity Calendar
June 22, 2008



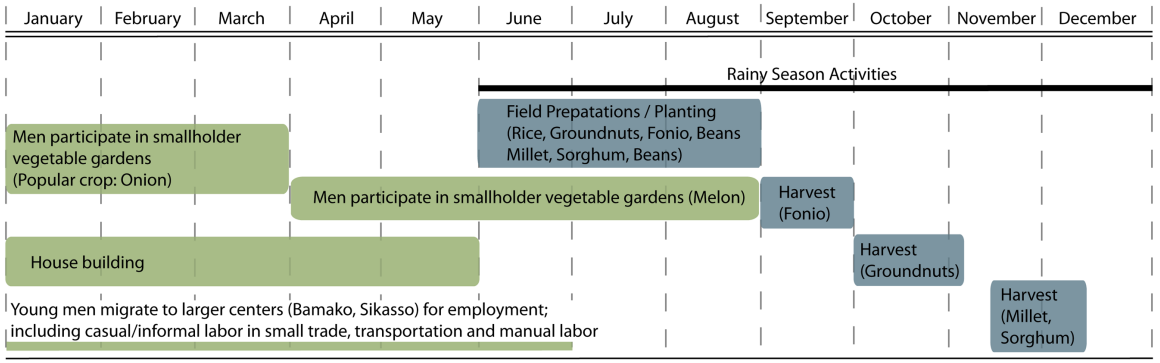
Bankouma-Bobo
Female Focus Group

Activity Calendar
June 25, 2008



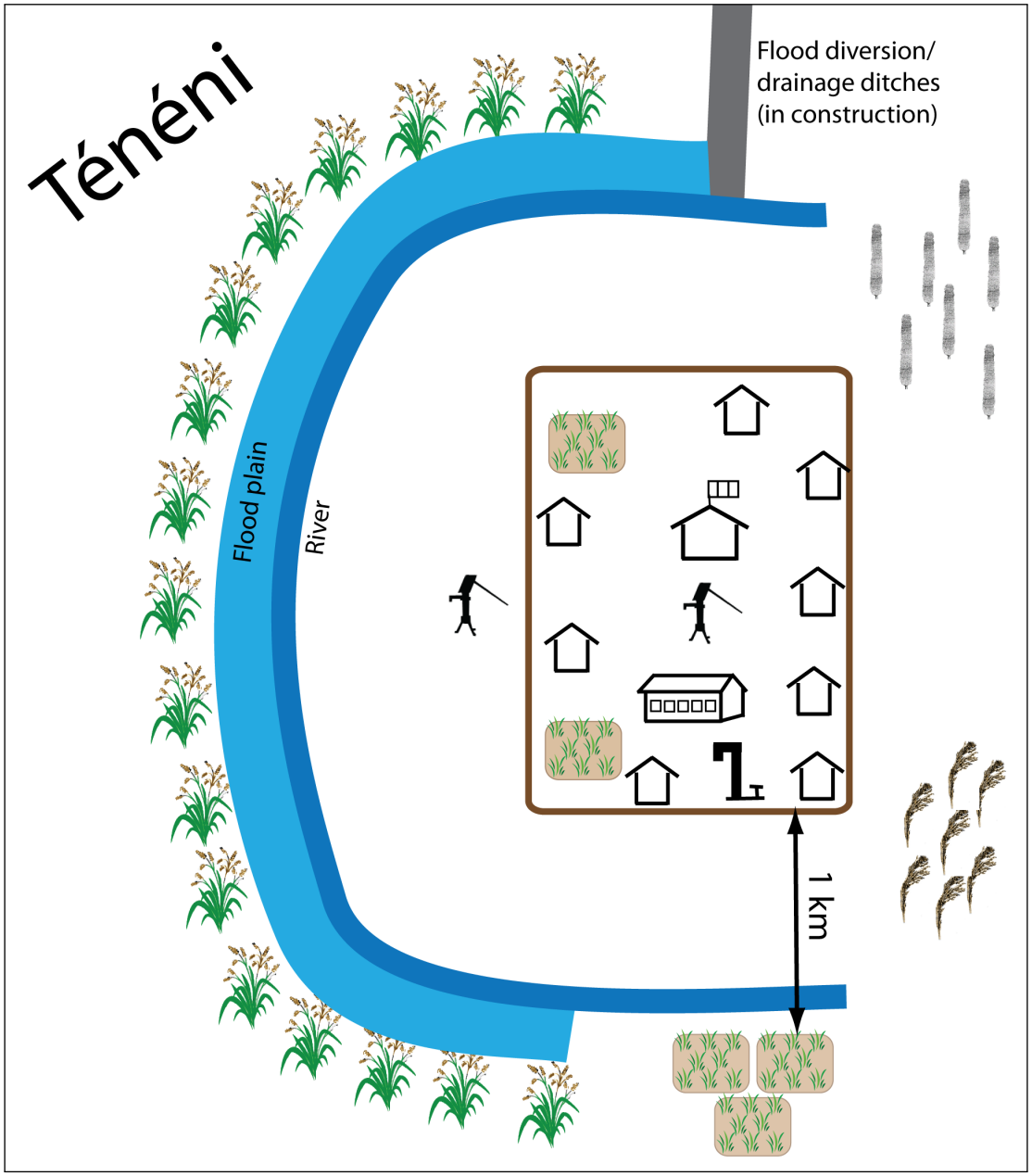
Bankouma-Bobo
Male Focus Group

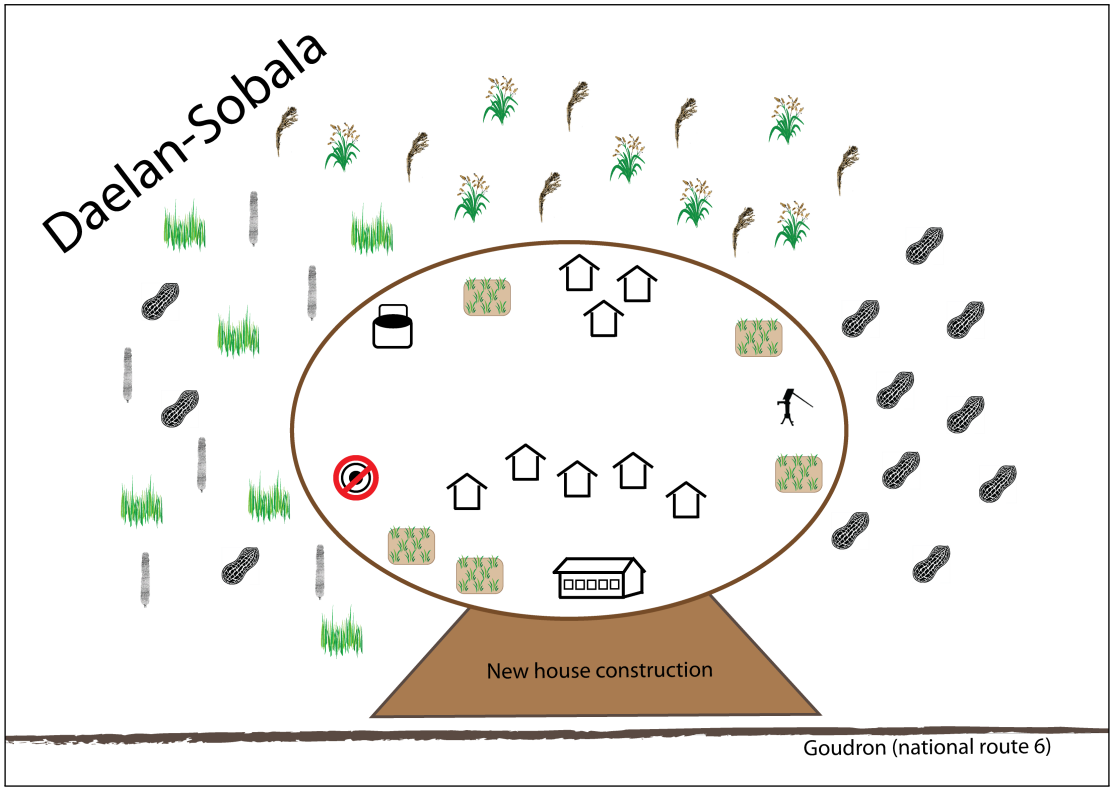
Activity Calendar
June 25, 2008

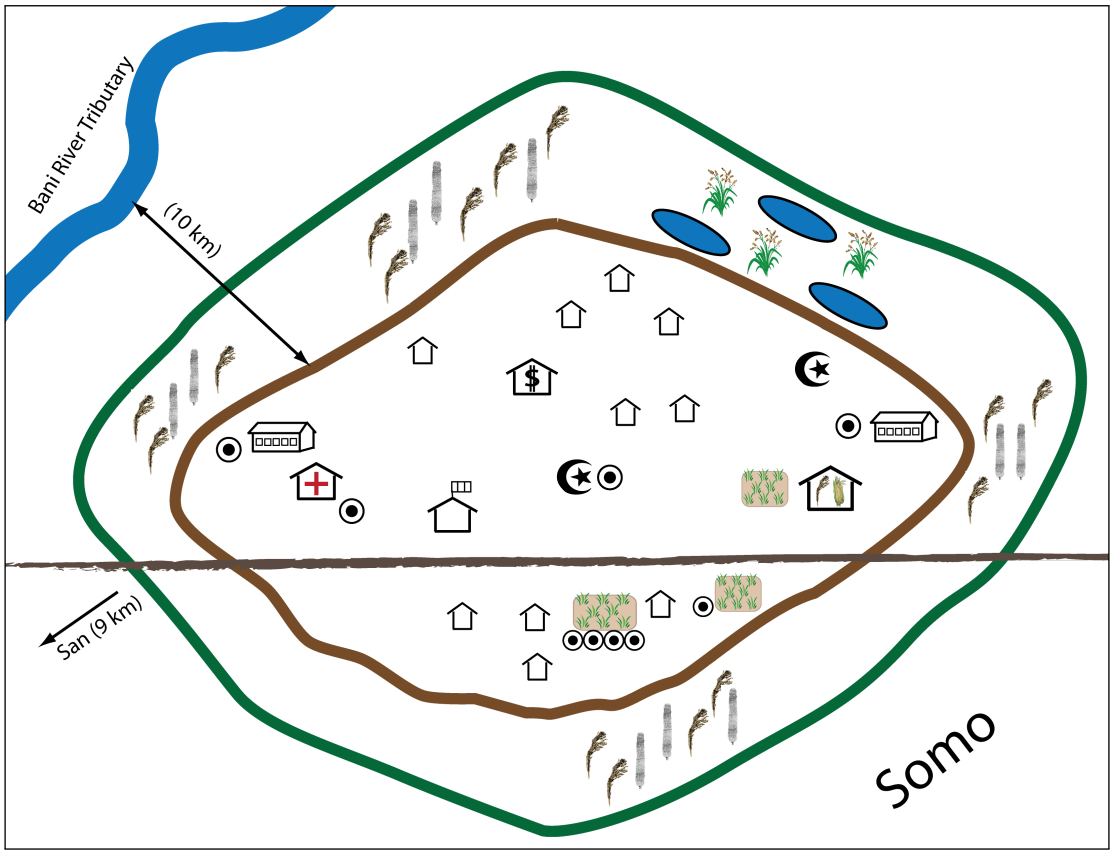


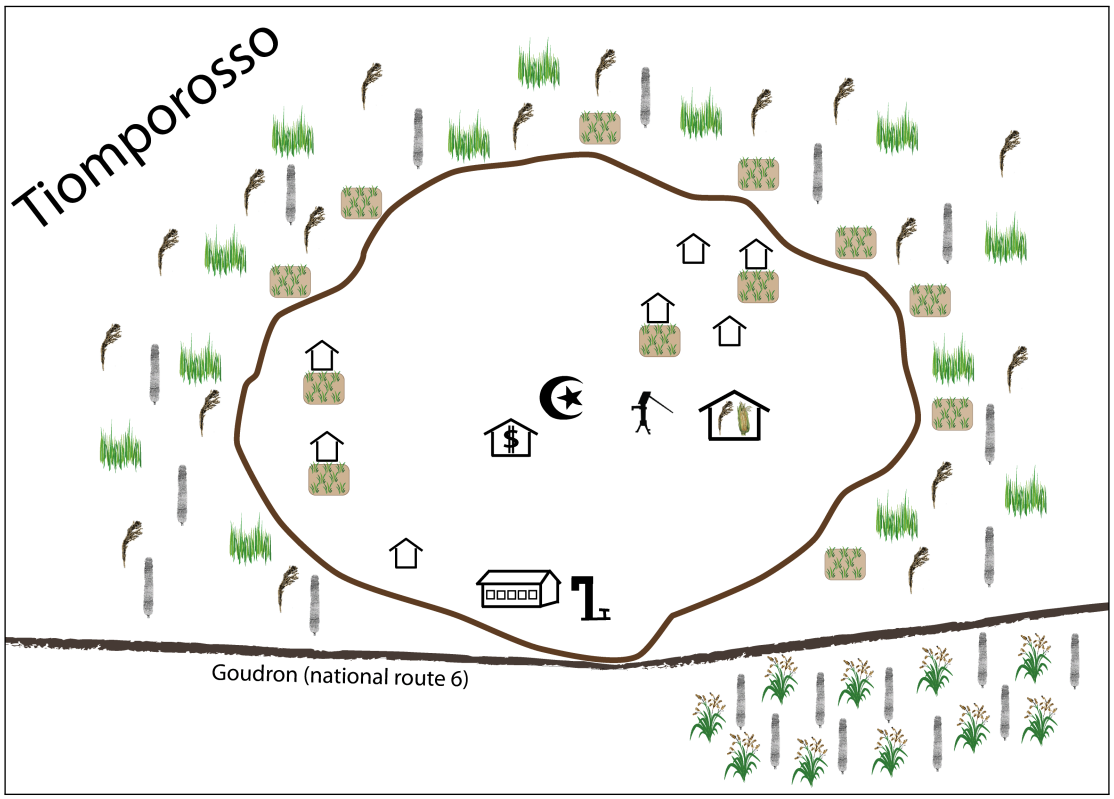
APPENDIX E

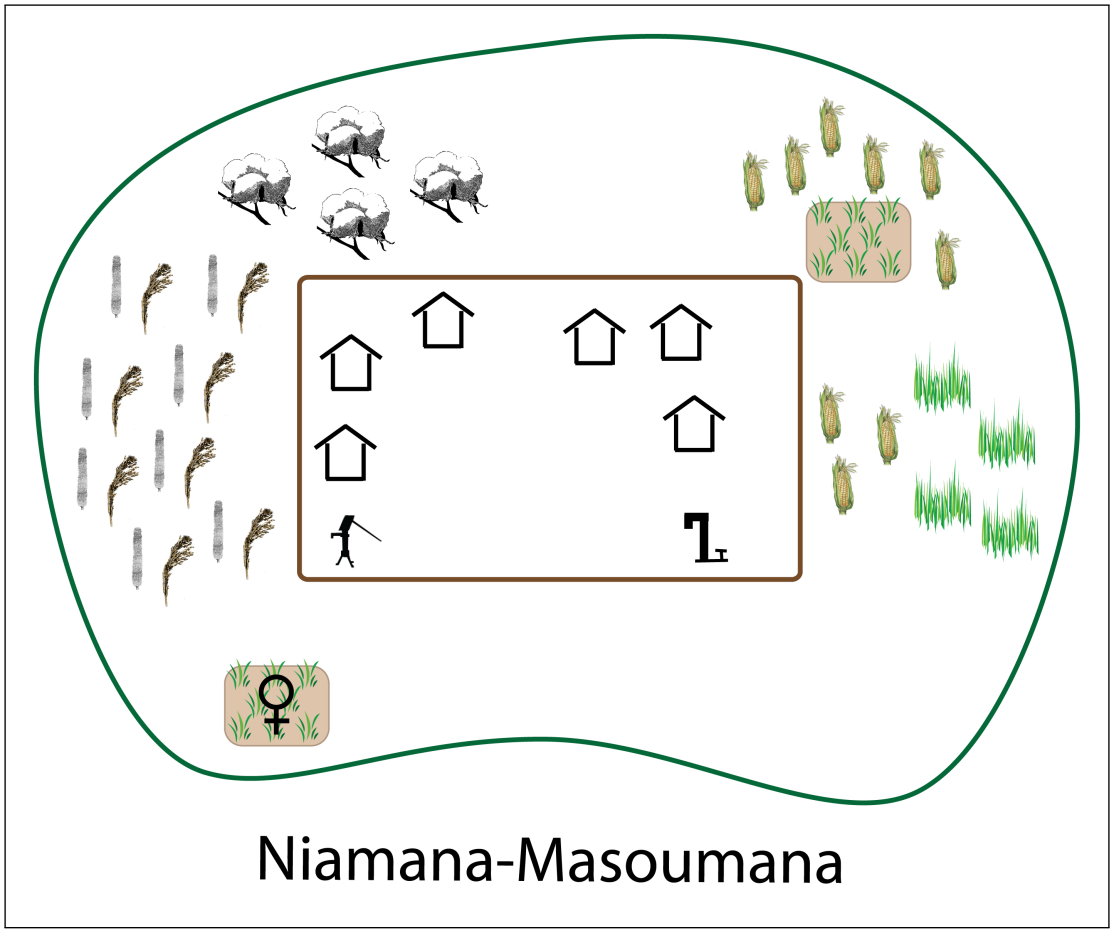
VILLAGE RESOURCE MAPS

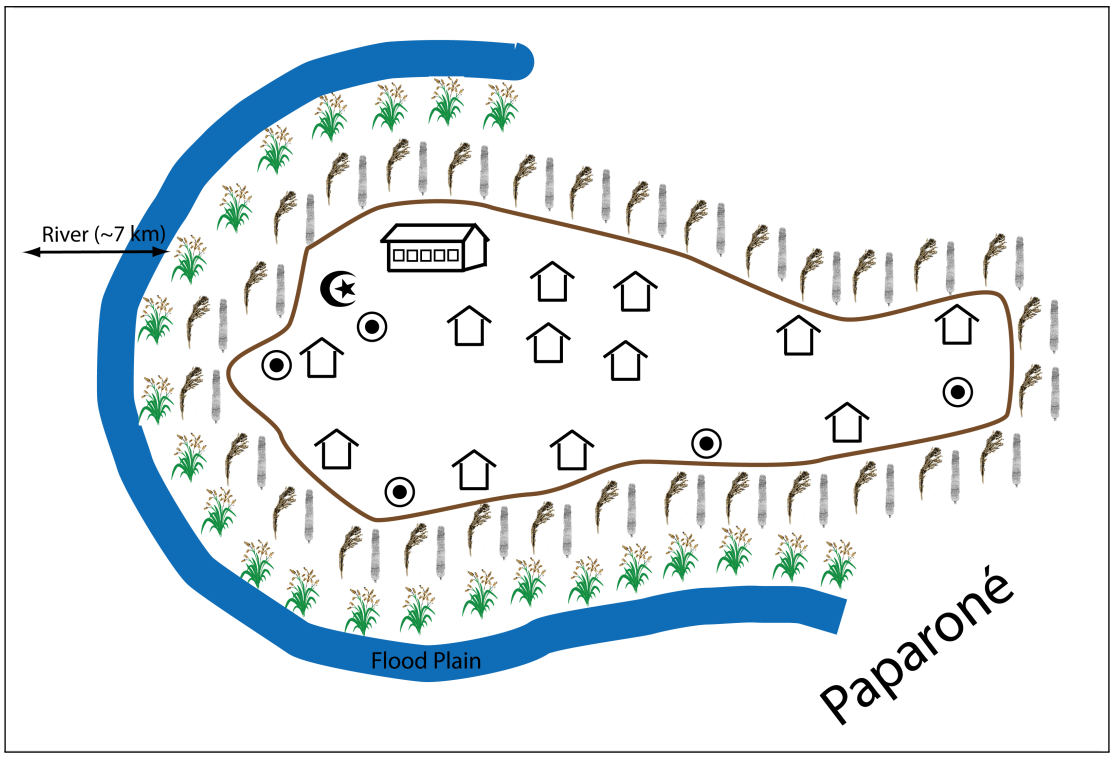


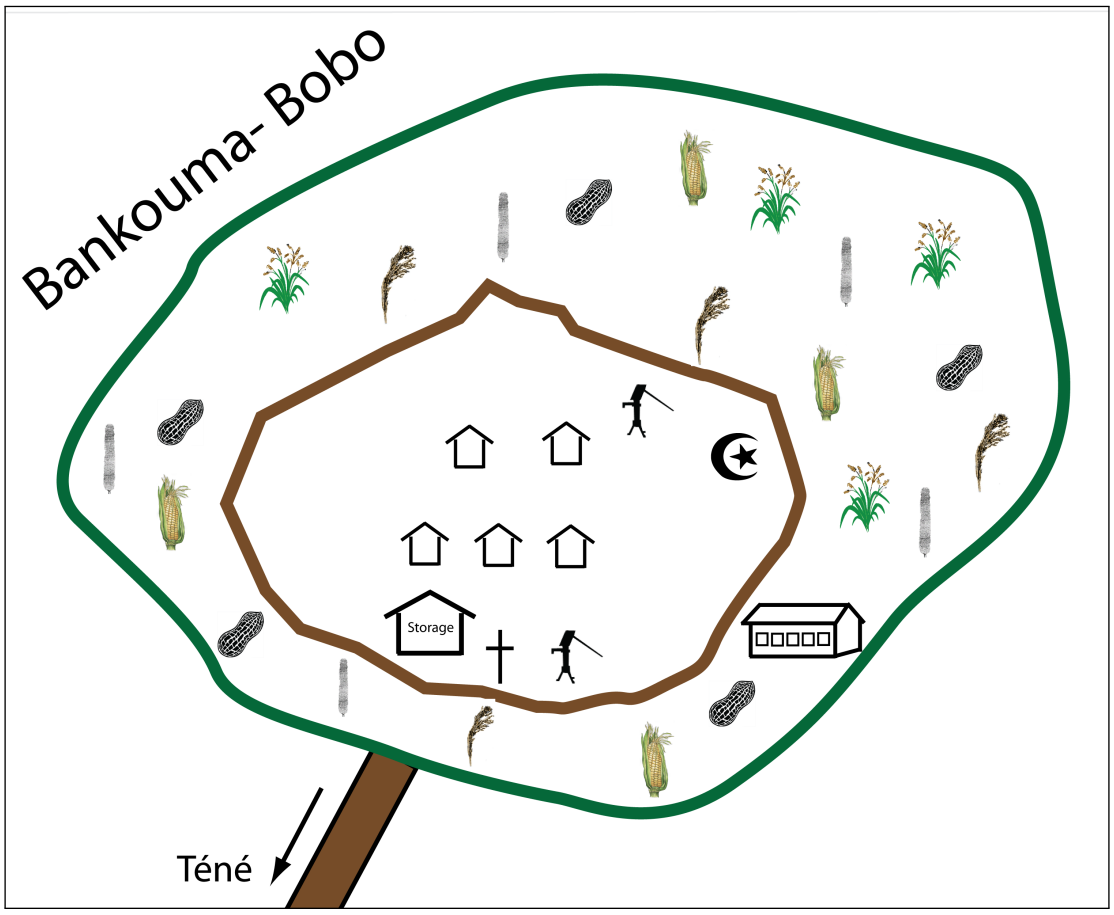

Daelan-Sobala
New house construction
Goudron (national route 6)


Bani River Tributary
(10 km)
San (9 km)
Somo


Tiomporosso
Goudron (national route 6)


Niamana-Masoumana


River (~7 km)
Flood Plain
Paparoné


Bankouma- Bobo
Storage
Téné

APPENDIX F

CLIMATE DATA

Monthly rainfall in the Cercle de San 1988-2007 (millimeters/month)

Year \Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
1988	0	0	0	42.8	6.2	25.4	327	286	85.8	1.2	0	0	774.6
1989	0	0	0	0	5.4	110	184	297	53.9	61.9	0	0	711.9
1990	0	0	0.6	9.2	9.2	64.0	198	130	104	13.1	0	0	527.3
1991	0	0.8	0.9	4	48.5	73.1	243	296	117	54.0	0	0	837.3
1992	25.3	0	0	2.2	1.8	72.5	159	127	125	0	1.6	0	513.1
1993	0	0	0	0	15.0	87.2	195	183	87.1	4.7	0	0	571.9
1994	0	0	0	0	31.7	53.6	170	172	157	59.9	0	0	644.1
1995	0	0	1.8	30.3	30.3	46.8	38.9	109	168	104	27.4	0	556.0
1996	0	0	0	48.0	16.6	118	143	198	236	17.7	0	0	776.7
1997	0	0	0	20.7	41.9	166	204	22.3	60.2	0	0	0	514.4
1998	0	0	0	13.0	73.1	109	183	198	227	12.0	0	0	815.2
1999	0.3	0	0.4	11.2	31.0	31.0	140	232	175	38.6	0	0	659.6
2000	0.4	0	8.8	8.1	97.3	55.0	152	225	99.2	14.0	0	0	660.4
2001	0	0	0	0.5	15.9	138	281	203	58.7	8.2	0	0	705.8
2002	0	0	0	0	20.8	40.4	146	145	67.9	44.6	0	0	464.9
2003	0	0	0	0	76.3	115	302	258	122	28.9	10.8	0	913.1
2004	0	0	0	1.0	3.5	95.1	246	218	75.7	10.5	0	0	650.0
2005	3.6	1.0	0.7	0	19.5	67.3	258	215	155	3.0	0	0	722.8
2006	0	0	0	14.2	29.2	55.1	153	187	186	31.2	0	0	655.7
2007	0	0	1.5	26.6	11.0	71.5	272	297	97.6	0	0	0	777.0
AVG	1.5	0.1	0.7	11.6	29.2	79.7	199.7	199.9	122.9	25.4	2.0	0.0	

Source: Service Météologique de San

Average monthly maximum and minimum temperatures
Cercle de San 1988-2007 (degrees Celsius)

Year\Month		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVG
1988	Tmax	31.5	35.7	39.4	40.6	41.7	36.9	34.6	31.1	32.0	36.4	35.4	30.2	35.5
	Tmin	15.8	20.0	24.6	27.0	28.2	26.0	23.4	23.0	23.2	23.1	19.7	14.8	22.4
1989	Tmax	32.2	34.0	37.9	40.8	40.7	36.7	32.6	30.8	32.9	35.1	36.9	33.7	35.4
	Tmin	14.9	17.8	22.0	25.6	27.4	25.1	23.2	22.6	23.3	22.7	20.2	17.6	21.9
1990	Tmax	35.4	38.6	41.0	40.7	40.7	37.6	38.4	32.8	33.5	37.9	37.9	34.1	37.4
	Tmin	18.3	21.1	27.8	27.4	27.4	25.3	22.9	22.8	22.9	23.3	20.4	18.6	23.2
1991	Tmax	34.6	36.4	39.4	41.0	32.3	36.9	33.7	31.8	34.0	34.9	37.0	33.6	35.5
	Tmin	18.0	20.3	23.8	26.1	26.9	25.6	23.5	23.0	23.0	22.3	20.1	16.7	22.4
1992	Tmax	30.4	37.0	36.5	40.2	39.7	37.2	33.0	31.8	32.8	36.4	34.6	34.6	35.4
	Tmin	16.3	20.6	22.0	26.1	27.3	25.5	23.1	22.5	22.8	22.8	19.2	16.7	22.1
1993	Tmax	31.0	35.7	38.9	40.7	41.2	36.9	33.3	32.4	33.4	37.8	36.8	33.4	36.0
	Tmin	15.5	19.5	23.4	26.7	28.7	25.4	23.6	22.6	22.9	24.0	21.4	16.4	22.5
1994	Tmax	31.1	36.4	38.7	33.7	38.9	37.2	33.7	30.8	31.9	33.2	35.1	31.9	34.4
	Tmin	15.5	18.5	23.4	26.7	26.3	25.1	23.7	22.3	23.0	22.8	19.8	15.8	21.9
1995	Tmax	30.5	34.1	37.8	39.5	39.6	38.9	38.5	35.3	31.9	33.2	36.8	33.4	35.8
	Tmin	13.3	16.7	24.0	27.5	27.4	26.5	25.9	24.5	22.8	23.6	24.2	18.6	22.9
1996	Tmax	37.2	35.5	38.6	39.9	39.8	37.6	34.9	31.8	32.1	35.5	35.5	34.7	36.1
	Tmin	20.8	17.9	24.8	26.2	27.5	26.5	24.4	22.5	23.0	23.1	18.3	17.2	22.7
1997	Tmax	36.4	34.5	37.6	39.2	36.0	34.1	32.9	33.6	36.5	37.4	33.8	33.7	35.5
	Tmin	18.8	17.8	22.1	26.1	25.2	24.4	23.7	24.0	23.8	20.4	17.4	16.9	21.7
1998	Tmax	33.0	38.1	38.5	41.6	38.5	36.0	34.0	32.3	32.5	36.3	36.2	33.0	35.8
	Tmin	16.8	21.2	22.8	28.2	27.5	25.9	24.3	23.5	23.3	24.6	20.0	17.5	23.0
1999	Tmax	31.8	33.3	39.0	39.8	40.3	38.5	33.7	30.6	30.9	34.3	36.3	33.2	35.1
	Tmin	17.2	17.2	23.1	26.4	28.0	26.6	23.7	23.0	22.8	23.1	21.0	16.4	22.4
2000	Tmax	35.0	33.7	38.2	41.7	39.0	36.7	33.4	32.5	33.7	36.2	36.6	33.1	35.8
	Tmin	19.9	16.5	21.6	27.7	27.2	25.5	23.6	22.8	23.6	23.0	19.2	16.2	22.2
2001	Tmax	33.5	34.9	40.2	40.9	40.4	34.6	32.7	32.0	33.4	37.3	36.8	35.6	36.0
	Tmin	15.5	17.2	22.7	26.0	27.7	24.6	23.5	23.3	23.2	23.5	20.0	17.9	22.1
2002	Tmax	32.6	35.8	40.2	40.9	40.7	38.3	35.3	33.0	n/a	36.8	37.1	34.1	36.8
	Tmin	17.4	18.0	24.1	27.4	28.3	26.3	24.4	23.5	n/a	23.8	20.4	18.1	22.9
2003	Tmax	33.0	38.1	39.5	41.7	40.1	35.7	33.4	30.9	31.9	36.8	36.6	33.8	36.0
	Tmin	17.8	21.0	23.3	27.9	27.8	25.2	23.3	22.9	23.3	24.5	21.7	16.4	22.9
2004	Tmax	33.0	36.7	38.4	40.5	41.3	37.7	32.6	33.0	34.3	38.4	31.3	36.3	36.1
	Tmin	16.9	20.5	22.8	27.1	27.9	26.0	23.3	23.2	23.4	23.9	21.4	19.6	23.0
2005	Tmax	31.6	36.4	40.2	41.7	40.2	36.9	33.3	32.1	33.5	37.6	37.7	35.2	36.4
	Tmin	17.2	22.9	26.0	27.6	27.6	25.7	23.3	23.2	23.9	24.3	20.8	18.3	23.4
2006	Tmax	33.2	35.8	39.8	33.9	40.2	37.7	35.6	32.5	32.8	36.4	36.3	32.9	35.6
	Tmin	17.2	19.5	23.5	27.0	27.7	25.7	24.5	23.9	28.5	24.3	19.6	24.4	23.8
2007	Tmax	32.9	36.8	39.7	41.0	41.2	38.6	33.8	31.4	33.7	37.0	28.8	32.9	35.7
	Tmin	16.5	18.6	23.4	27.7	28.6	26.4	24.1	23.0	23.9	24.6	21.4	17.1	22.9
AVG	Tmax	33.0	35.9	39.0	40.0	39.6	37.0	34.2	32.1	33.0	36.2	35.7	33.7	
	Tmin	17.0	19.1	23.6	26.9	27.5	25.7	23.8	23.1	23.5	23.4	20.3	17.6	

Source: Service Météologique de San

APPENDIX G

ANIMAL HOLDINGS

Ténéni

Date	Bovine	Sheep	Goat	Donkey	Horse
1999	1501	3200	3300	15	123
2000	1562	3400	3600	20	126
2001	1623	3600	3900	25	129
2002	1684	2800	4200	30	132
2003	1745	3000	4500	40	135
2004	1806	3200	4800	59	138
2005	1867	3400	5100	64	141
2006	1928	3600	5400	66	144
2007	1989	3800	5700	70	147
2008	2050	4000	6000	75	150

Daelan-Sobala

Date	Bovine	Sheep	Goat	Donkey	Horse
1999	260	1925	2398	35	40
2000	270	2100	2400	40	45
2001	280	2275	2600	43	49
2002	290	2450	2800	44	52
2003	300	2625	3000	45	56
2004	310	2800	3200	46	60
2005	320	2975	3400	47	65
2006	330	3150	3600	48	68
2007	340	3325	3800	49	70
2008	350	3500	4000	50	75

*All animal holding data were collected from *Service Agricole, Cercle de San (July 2008).*

Somo

Date	Bovine	Sheep	Goat	Donkey	Horse
1999	922	1100	1650	41	82
2000	959	1200	1800	42	84
2001	996	1300	1950	43	86
2002	1033	1400	2100	44	88
2003	1070	1500	2250	45	90
2004	1107	1600	2400	46	92
2005	1144	1700	2250	47	94
2006	1181	1800	2700	48	96
2007	1218	1900	2850	49	98
2008	1255	2000	3000	50	100

Diakourouna-Nirisso

Date	Bovine	Sheep	Goat	Donkey	Horse
1999	346	180	274	2	3
2000	359	195	296	10	6
2001	372	210	318	15	9
2002	385	225	340	25	11
2003	398	240	362	27	14
2004	411	255	384	30	15
2005	424	270	406	33	18
2006	437	285	428	34	19
2007	450	300	450	35	20
2008	563	350	472	37	22

Niamana-Masoumana

Date	Bovine	Sheep	Goat	Donkey	Horse
1999	314	1100	1375	40	0
2000	325	1200	1500	45	0
2001	336	1300	1625	50	0
2002	347	1400	1750	56	0
2003	358	1500	1875	60	0
2004	369	1600	2000	64	2
2005	380	1700	2125	67	3
2006	391	1800	2250	70	5
2007	402	1900	2375	73	7
2008	413	2000	2500	75	10

Tiomporosso

Date	Bovine	Sheep	Goat	Donkey	Horse
1999	270	300	420	21	0
2000	280	325	450	23	0
2001	290	350	490	24	0
2002	300	375	525	25	0
2003	310	400	560	26	2
2004	320	425	595	27	4
2005	330	450	630	28	6
2006	340	475	665	29	8
2007	350	500	700	30	10
2008	360	525	735	32	12

Paparoné

Date	Bovine	Sheep	Goat	Donkey	Horse
1999	310	825	1132	57	32
2000	321	900	1234	59	34
2001	332	975	1336	61	36
2002	342	1050	1438	63	38
2003	354	1125	1540	65	40
2004	365	1200	1642	67	42
2005	376	1275	1744	69	44
2006	387	1350	1846	71	46
2007	398	1426	1948	73	48
2008	409	1500	2050	75	50

Bankouma-Bobo

Date	Bovine	Sheep	Goat	Donkey	Horse
1999	111	441	617	36	40
2000	114	481	673	38	42
2001	117	521	729	40	44
2002	121	561	785	41	46
2003	125	601	841	42	48
2004	129	641	892	44	50
2005	133	681	953	46	52
2006	137	721	1009	48	54
2007	141	761	1012	50	56
2008	145	801	1065	52	58

APPENDIX H

SUPPLEMENTARY DATA – WATER RESOURCES MANAGEMENT

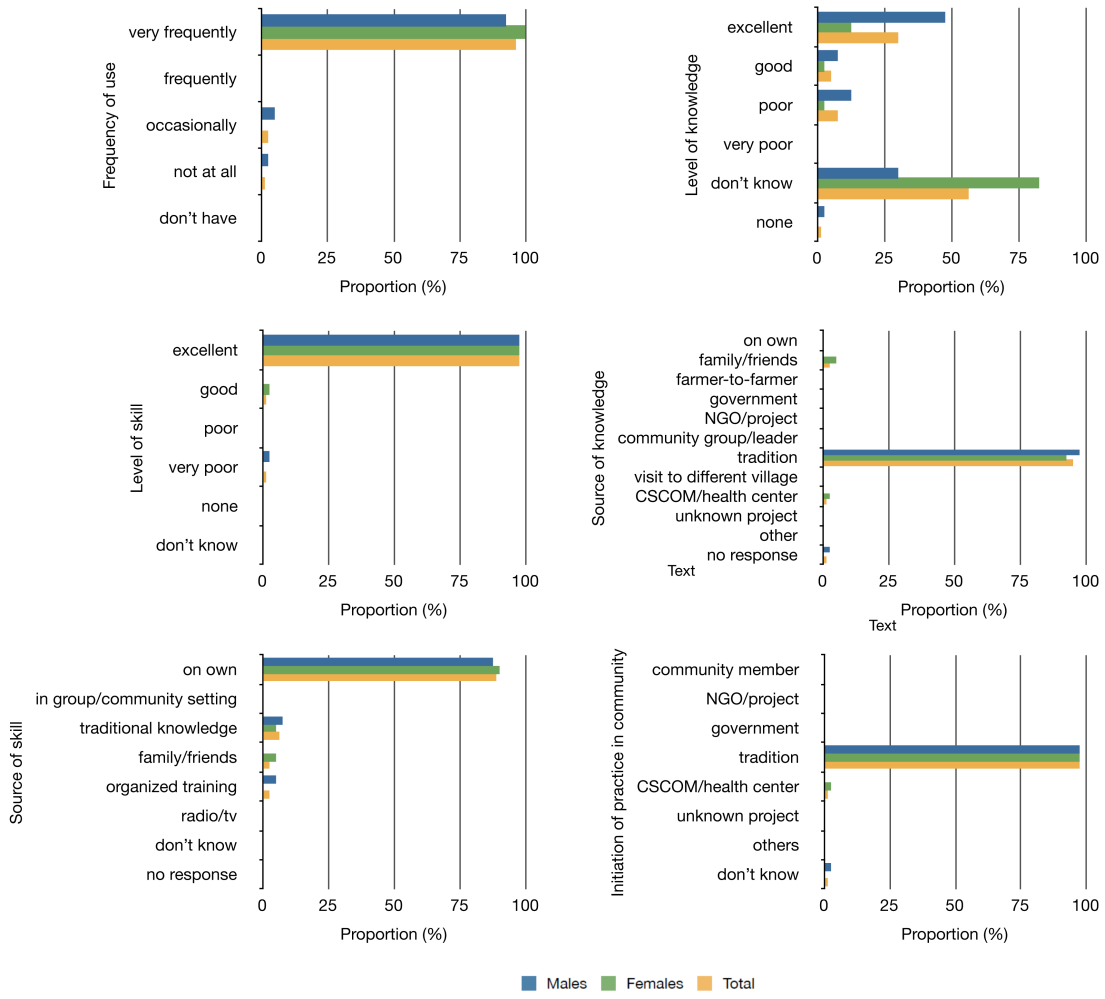


Figure H.1: Water resource management practices – Hand dug wells

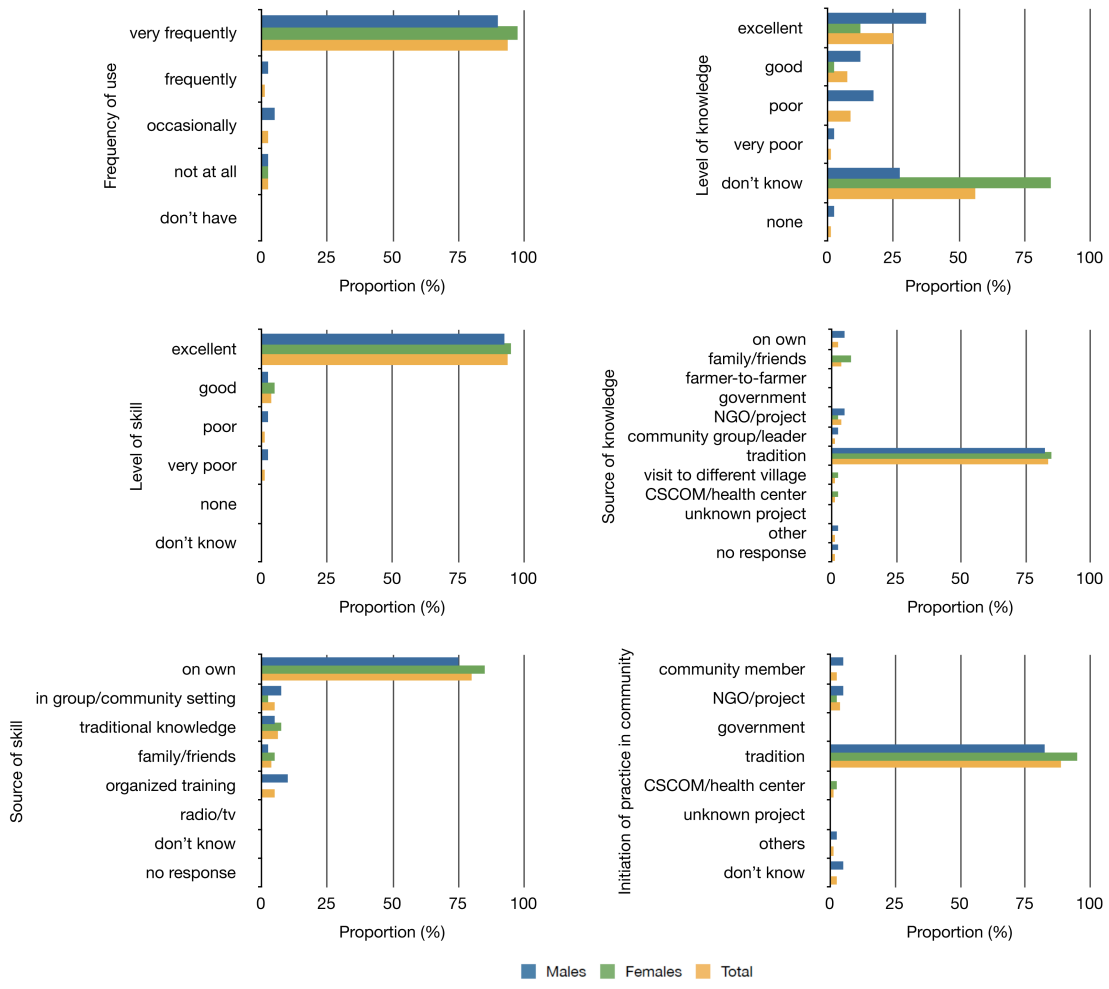


Figure H.2: Water resource management practices – Protected well

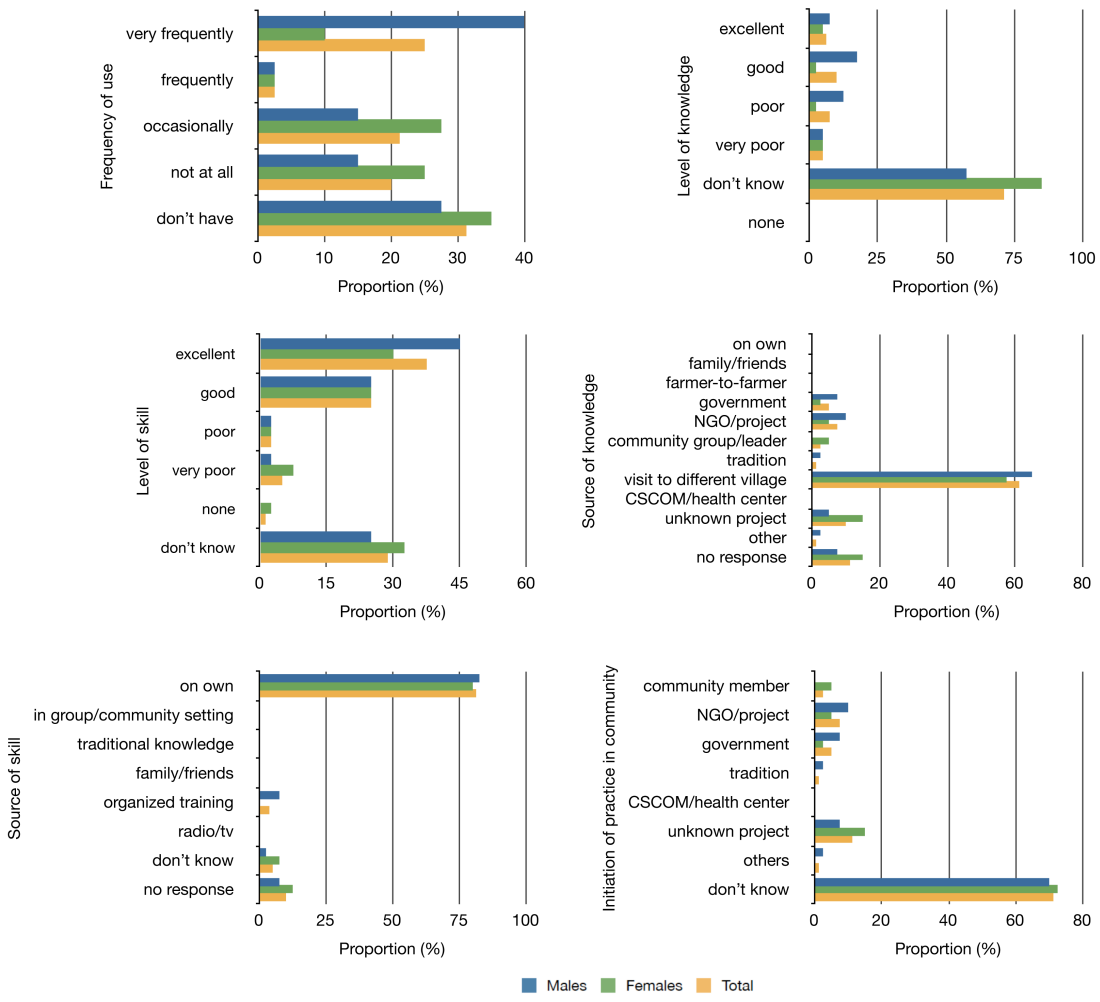


Figure H.3: Water resource management practices – Modern well

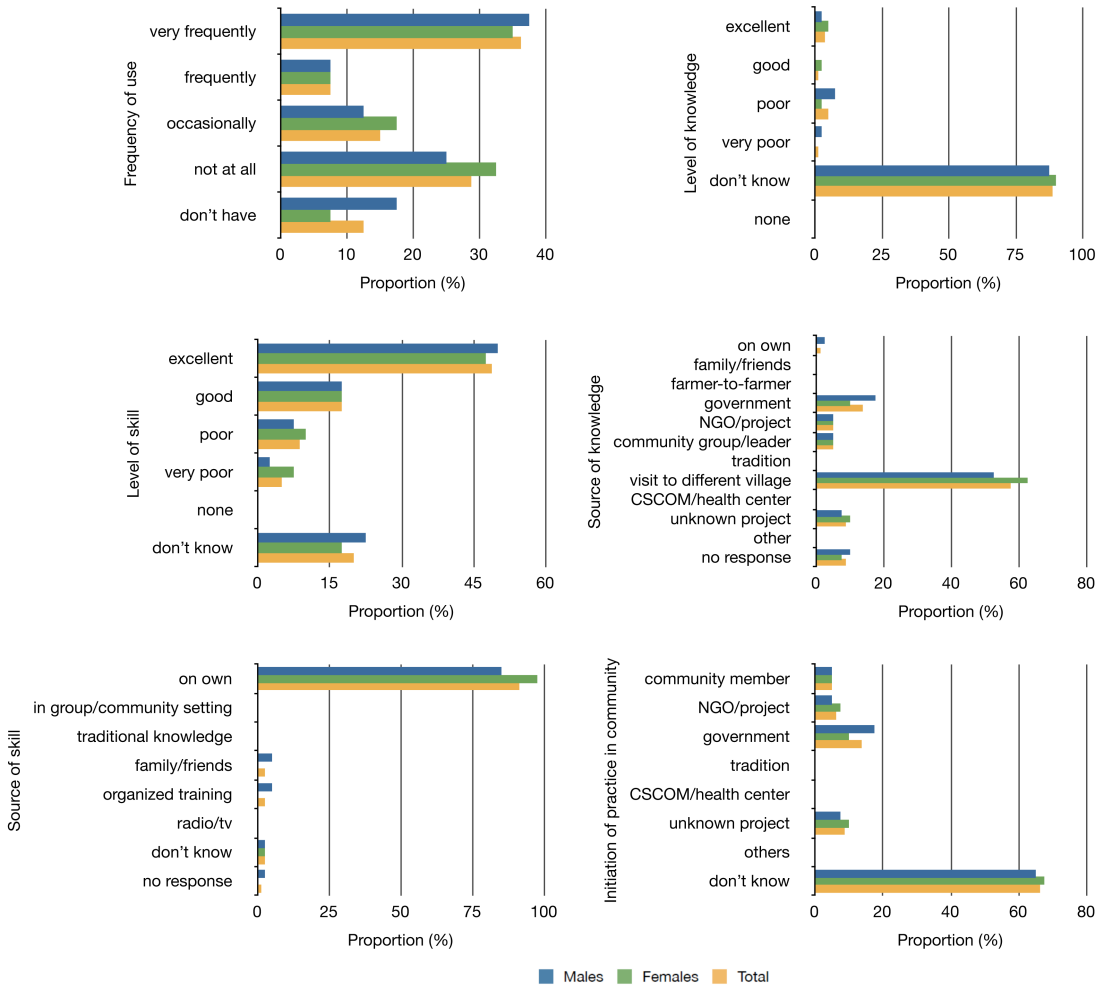


Figure H.4: Water resource management practices – Foot pump

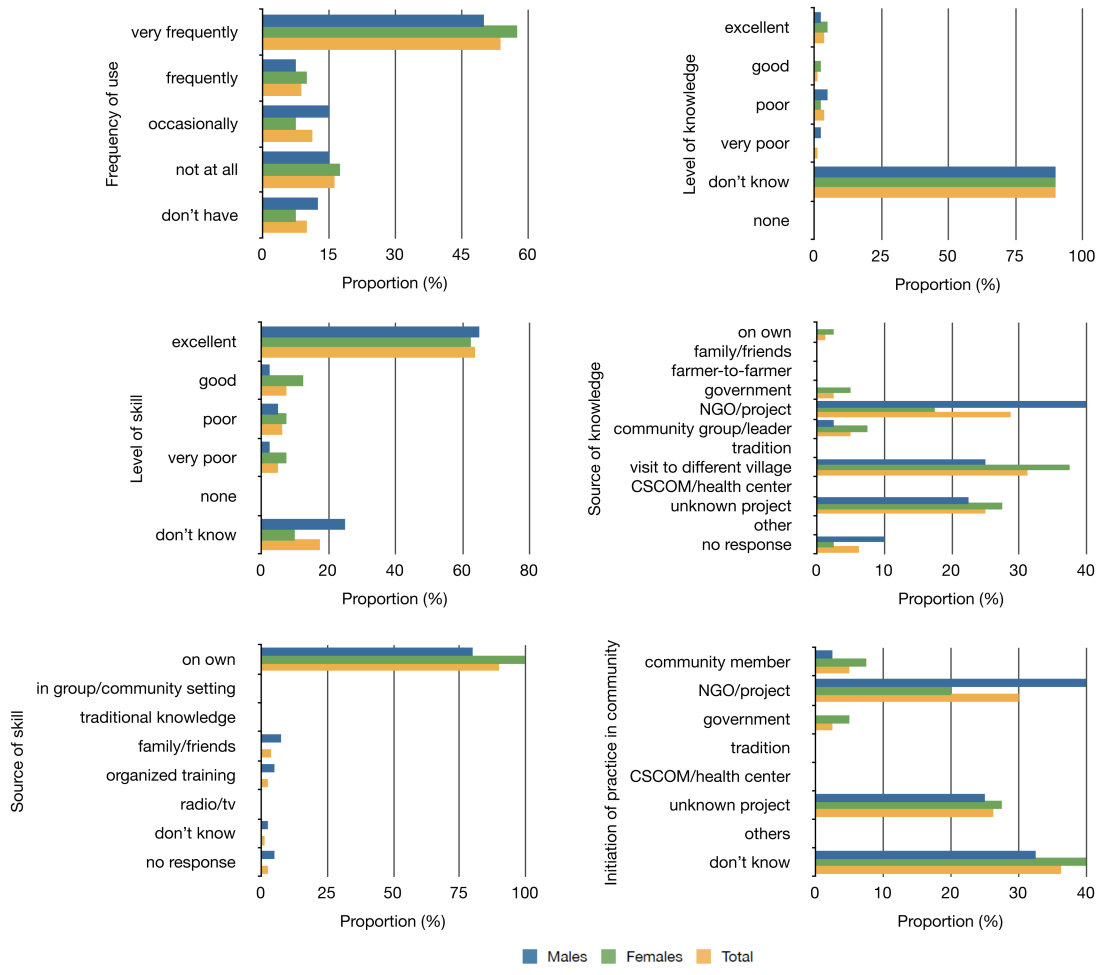


Figure H.5: Water resource management practices – Hand pump

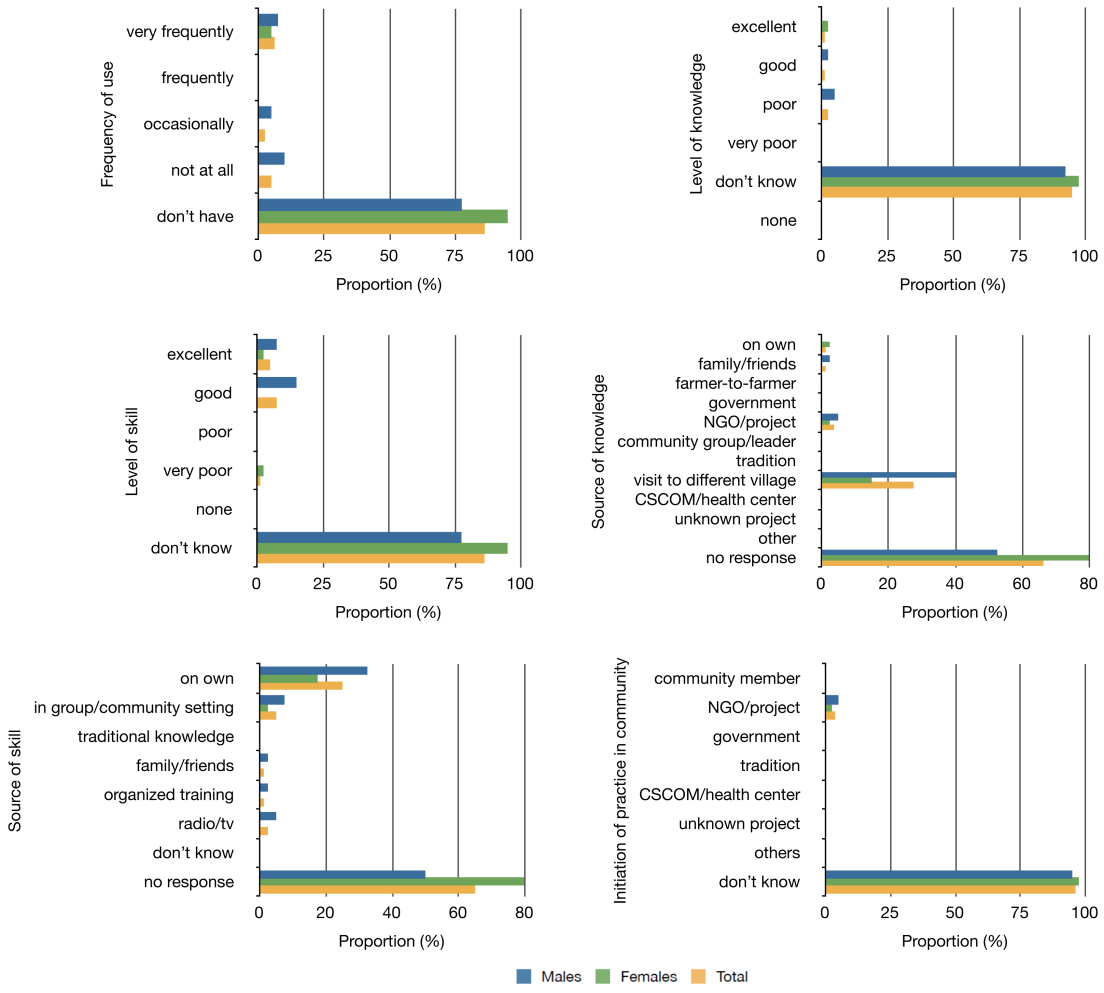


Figure H.6: Water resource management practices – Treadle pump

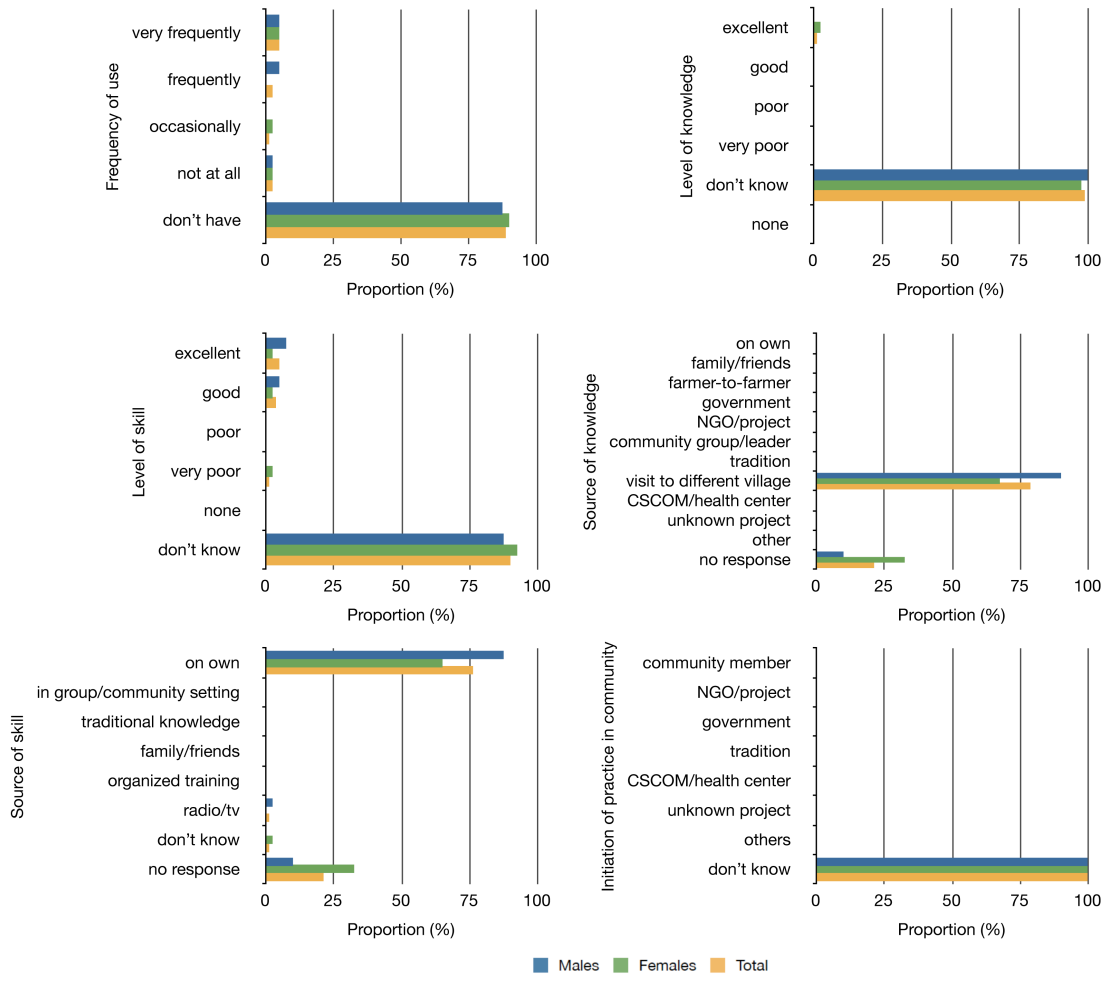


Figure H.7: Water resource management practices – Water tower/tap system

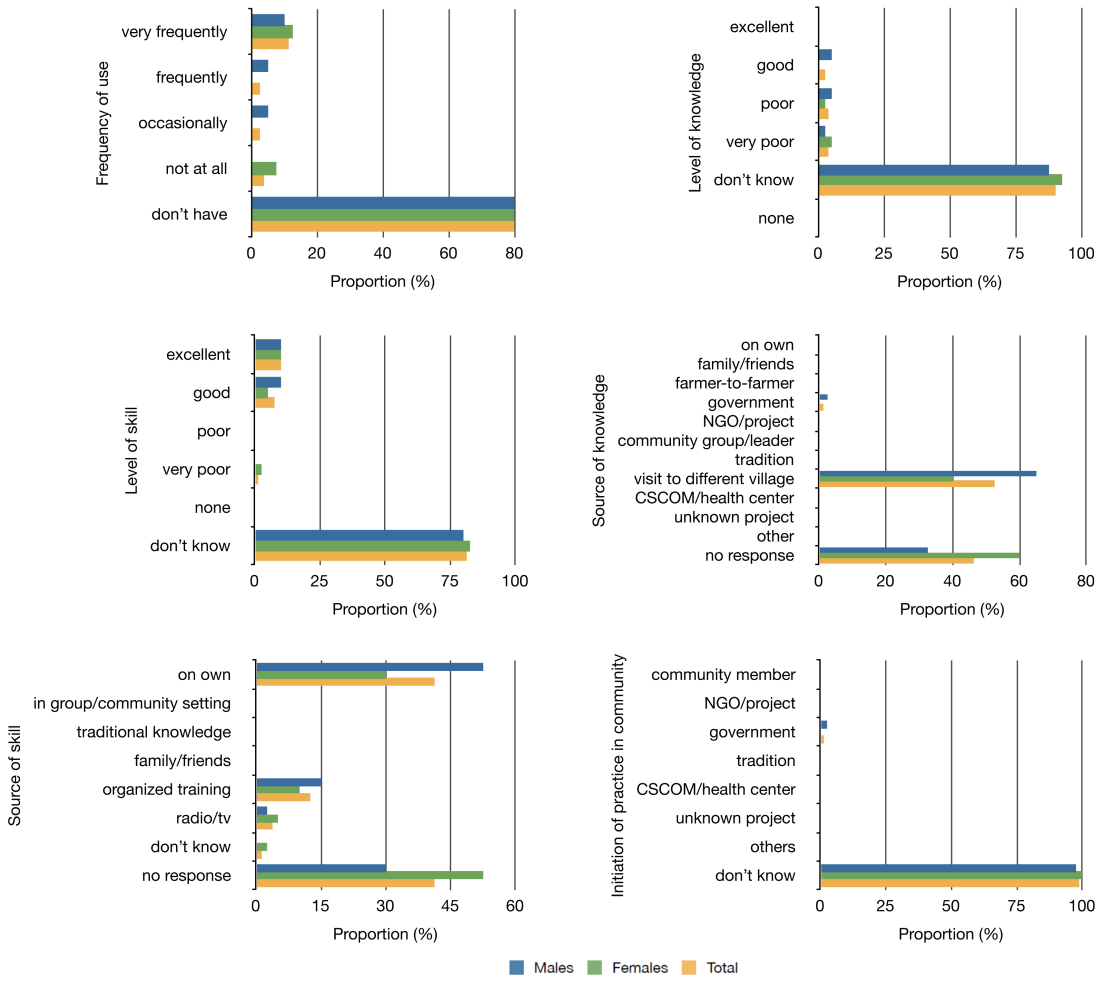


Figure H.8: Water resource management practices – River protection

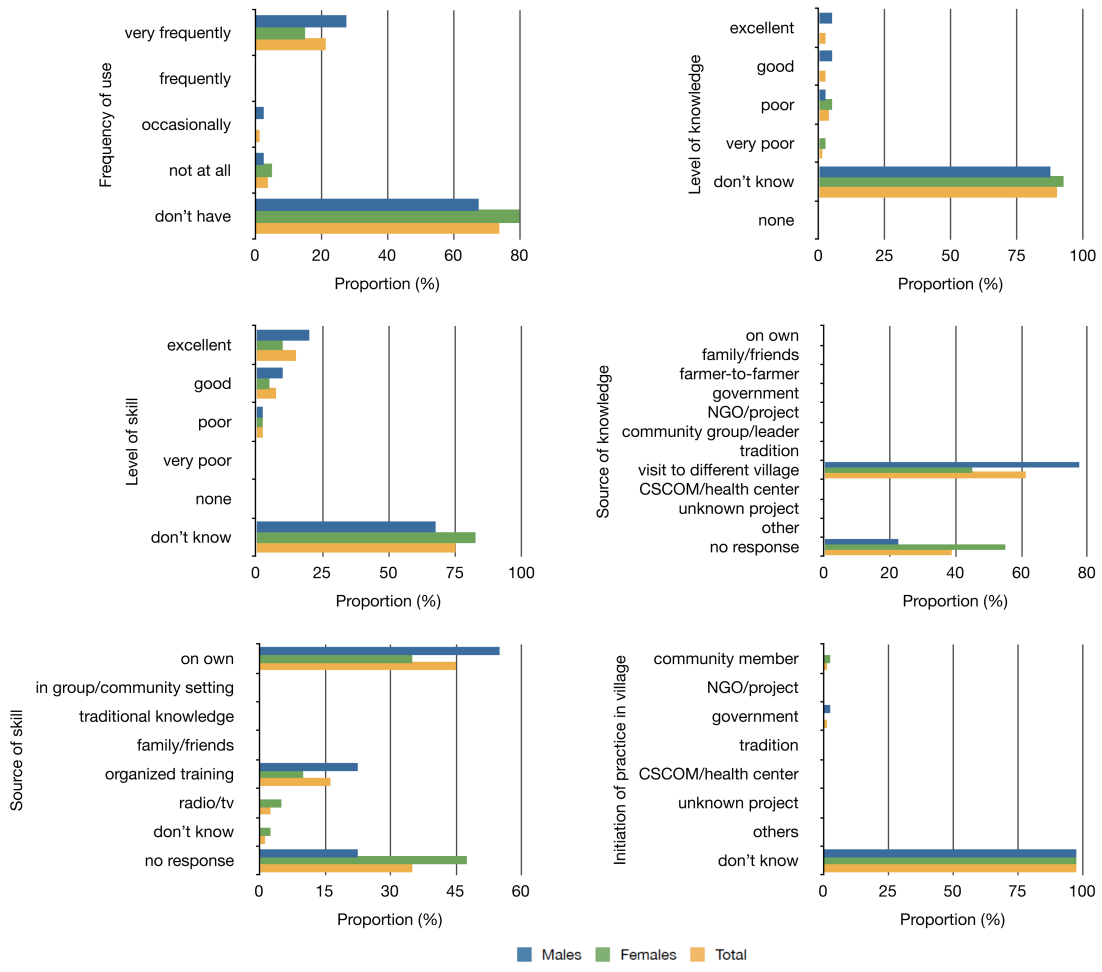


Figure H.9: Water resource management practices – Drainage ditches

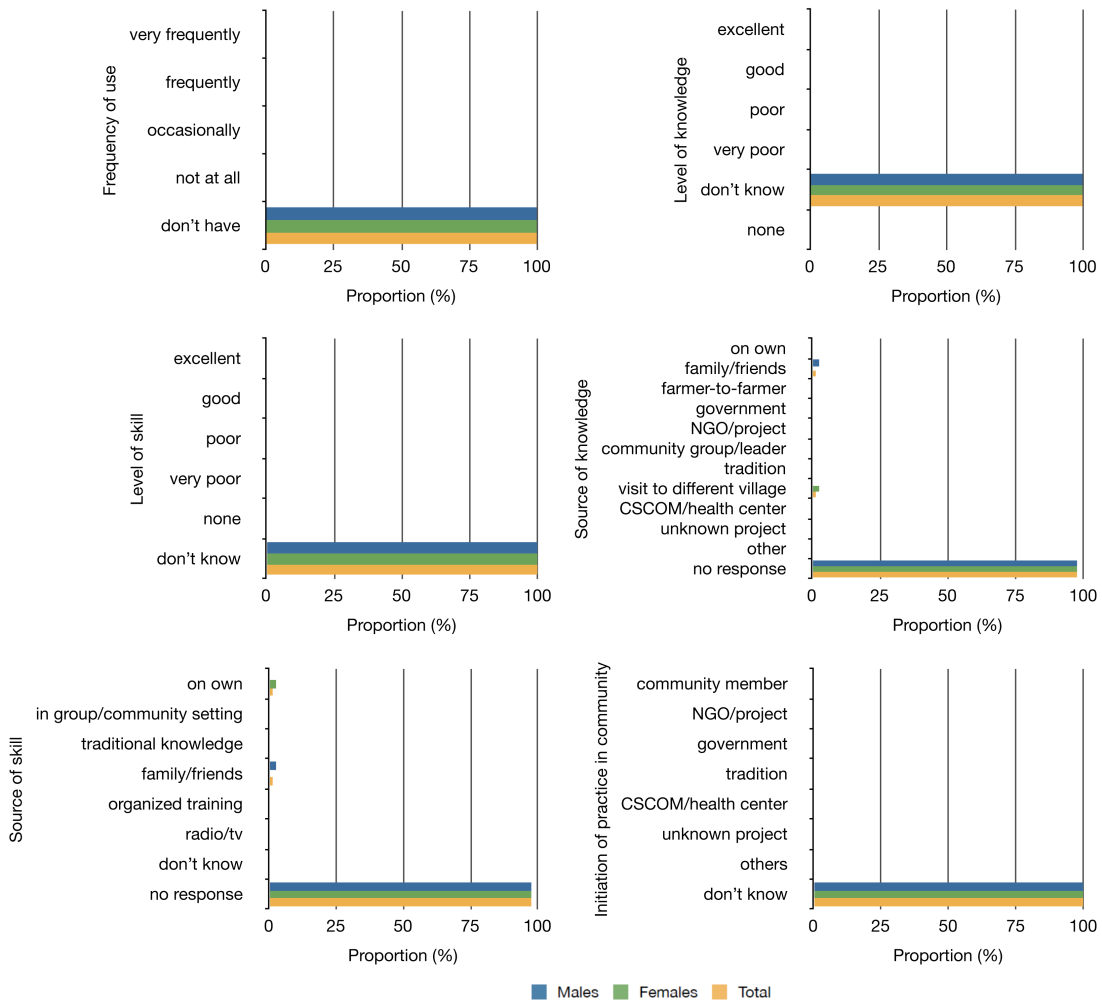


Figure H.10: Water resource management practices – Roof catchment

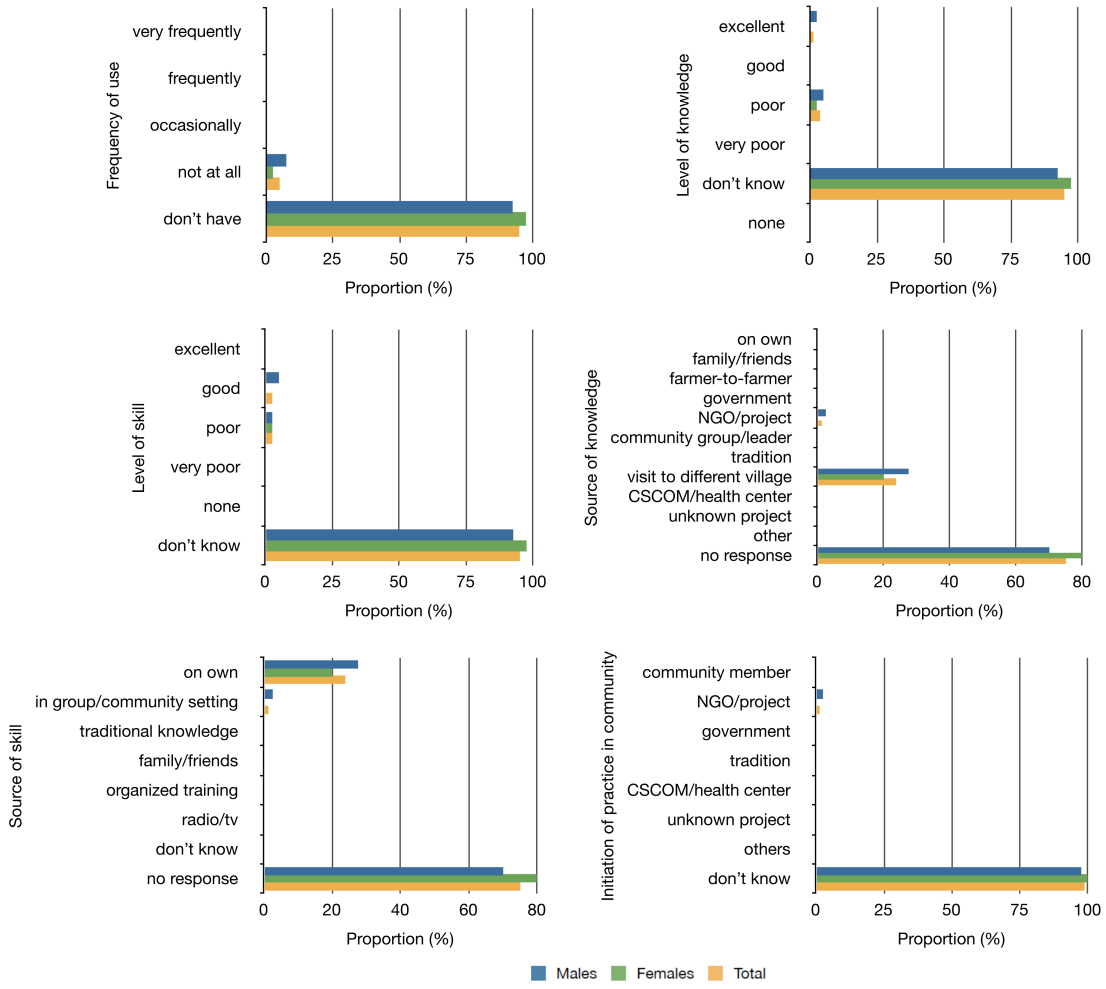


Figure H.11: Water resource management practices – Drip irrigation

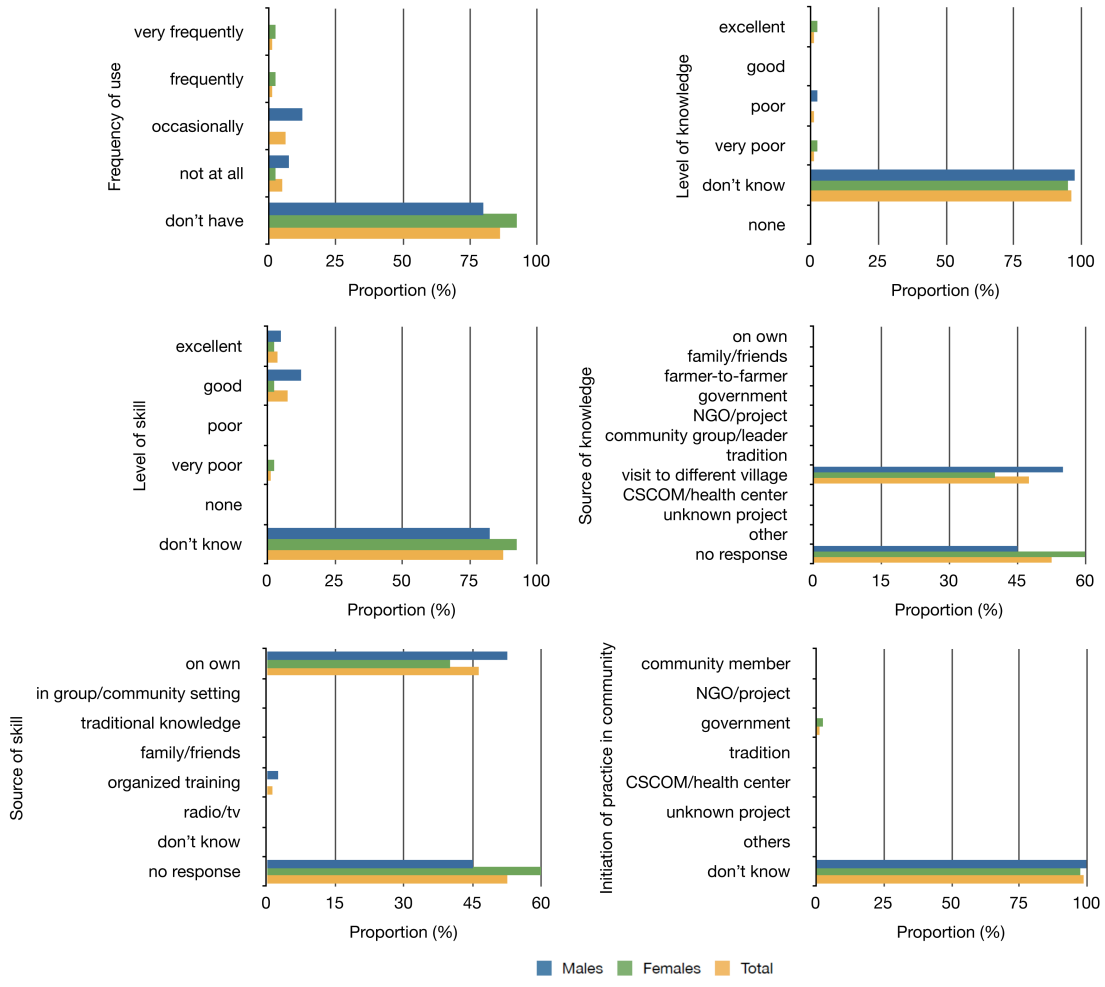


Figure H.12: Water resource management practices – Solar pump

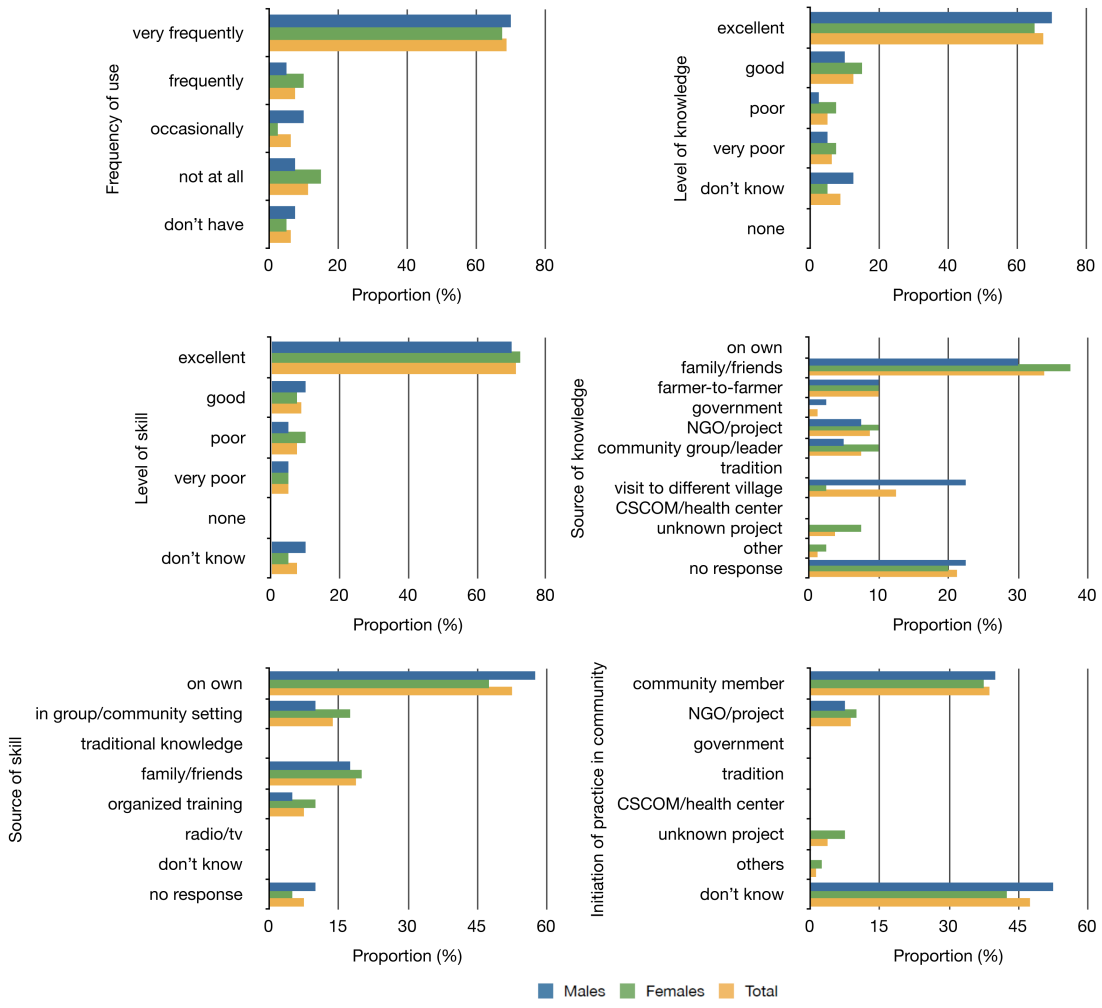


Figure H.13: Water resource management practices – Garden

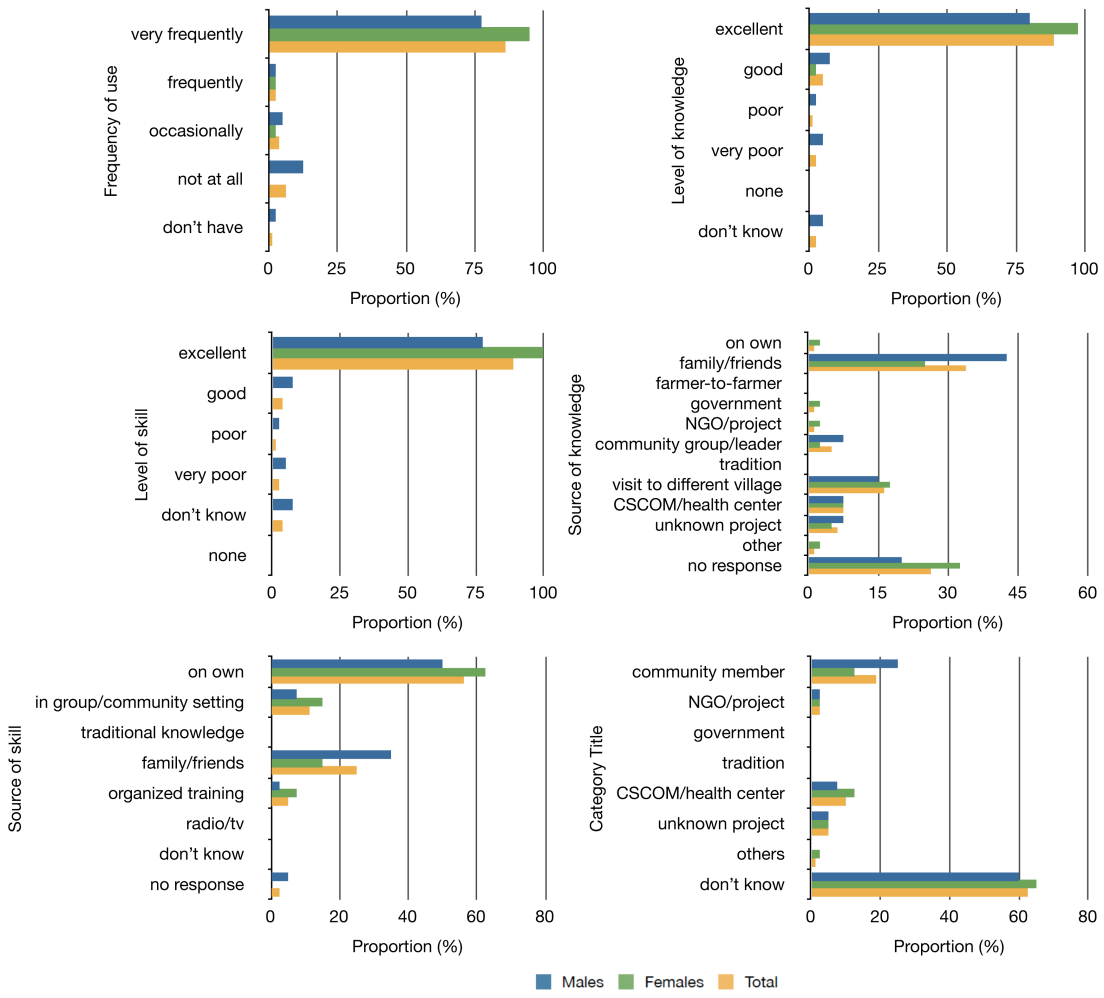


Figure H.14: Water resource management practices – Filtering HH water

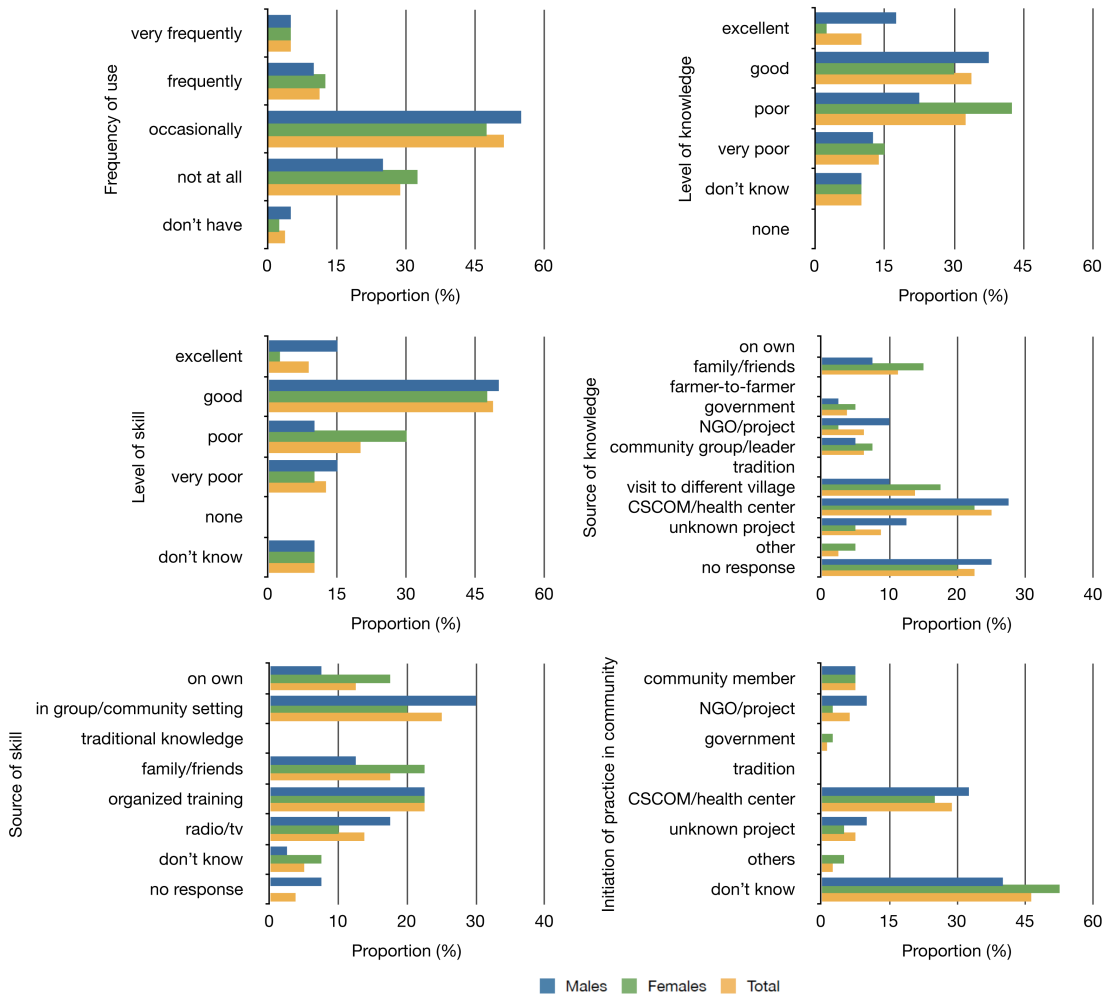


Figure H.15: Water resource management practices – Disinfecting HH water (bleach)

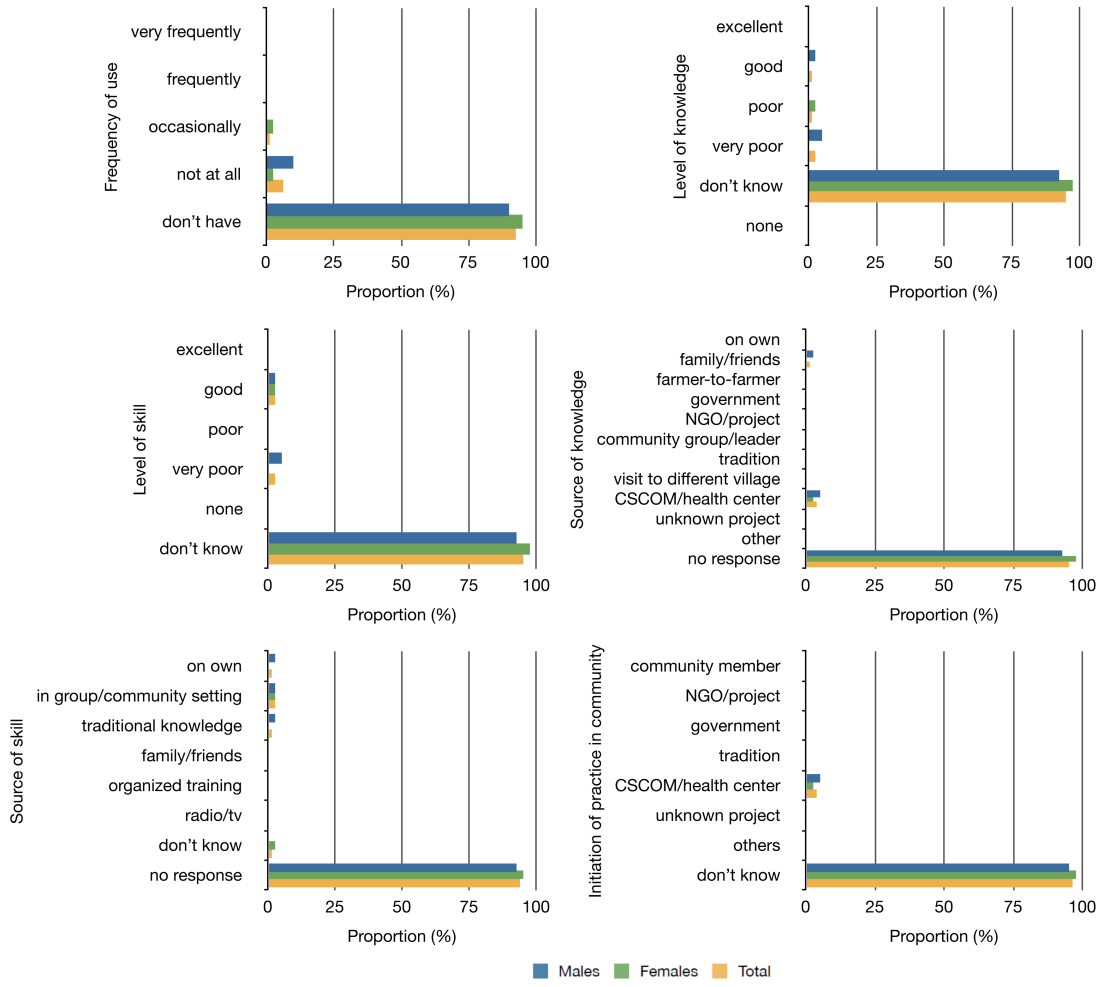


Figure H.16: Water resource management practices – Disinfecting private well (bleach)

APPENDIX I

SUPPLEMENTARY DATA – ADDITIONAL COMMUNITY PRACTICES

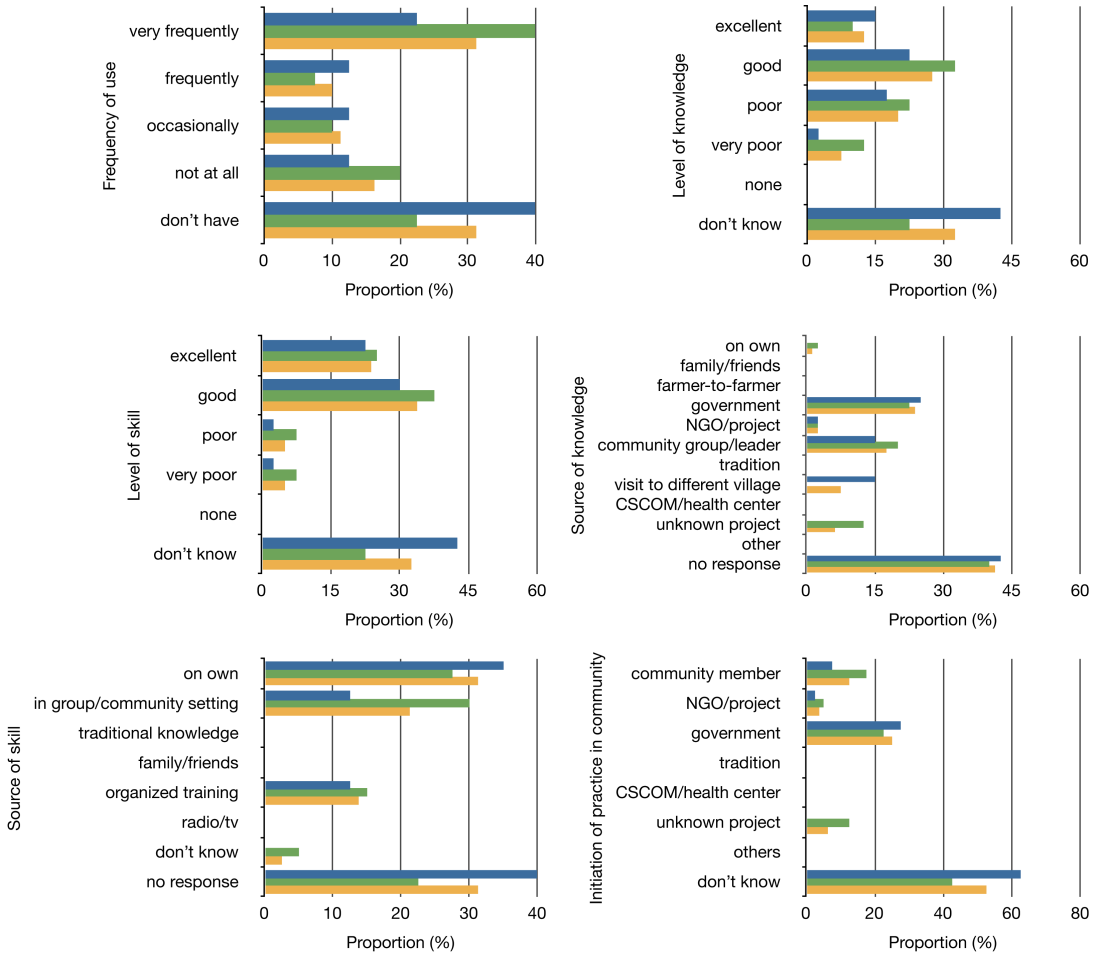


Figure I.1: Additional community practices – Microcredit

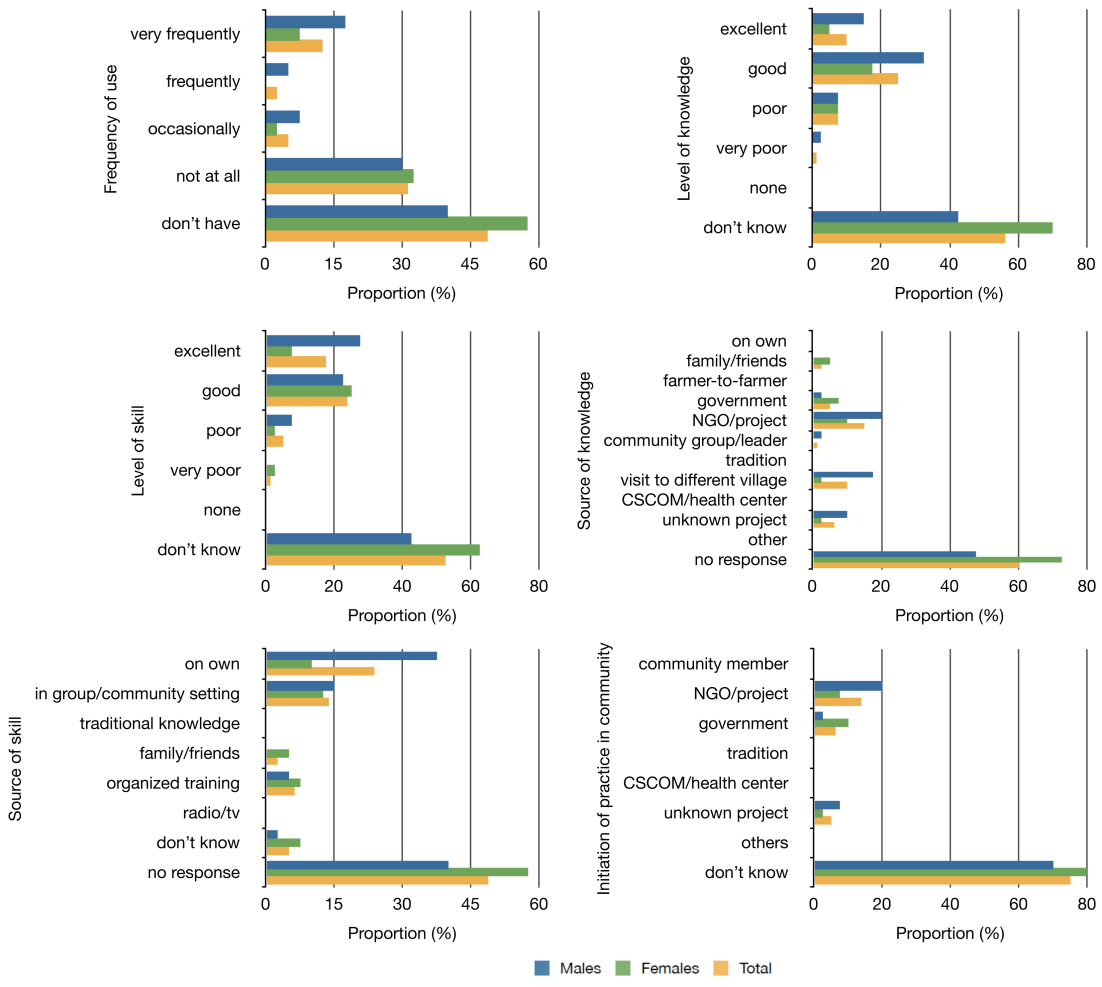


Figure I.2: Additional community practices – Cereal banks

REFERENCES

ADF (1997). Moyen Bani Plains Development Programme: Summary of the Environmental Impact Assessment. Tech. rep., African Development Fund.

Adger, W. N. (2003). Social Capital, Collective Action, and Adaptation to Climate Change. *Economic Geography*, *79*(4), 387–404.

Agarwal, B. (2001). Participatory exclusions, community forestry, and gender: An analysis for South Asia and a conceptual framework. *World Development*, *29*(10), 1623–1648.

Akabayashi, H., & Psacharopoulos, G. (1999). The trade-off between child labour and human capital formation: A Tanzanian case study. *Journal of Development Studies*, *35*(5), 120–140.

Ali, A. M. S. (2005). Home Gardens in Smallholder Farming Systems: Examples from Bangladesh. *Human Ecology*, *33*(2), 245–270.

ARD/USAID (2007). WAWI Mid-Term Status Review. Contract no. lag-i-00-99-00018-00, USAID.

Arnstein, S. (1969). A Ladder of Citizen Participation. *Journal of the American Institute of Planners*, *35*, 216–224.

Baden, S., & Goetz, A. M. (1998). *Feminist Visions of Development*, chap. Who needs [sex] when you can have [gender]? Conflicting Discourses on Gender in Beijing, (pp. 19–38). New York: Routledge.

Bandura, A. (1977). *Social Learning Theory*. New York: General Learning Press.

Bates, R. H. (2008). *When Things Fell Apart: State failure in late-century Africa*. New York: Cambridge University Press.

Benería, L. (1981). Conceptualizing the labor force: The underestimation of women's economic activities. *Journal of Development Studies*, *17*(3), 10–28.

Benería, L. (2003). *Gender, Development, and Globalization: Economics as if All People Mattered*. New York: Routledge.

Benjamin, C. E. (2008). Legal Pluralism and Decentralization: Natural Resource Management in Mali. *World Development*, *36*(11), 2255–2276.

Benjaminsen, T. A. (1997). Natural Resource Management, Paradigm Shifts, and the Decentralization Reform in Mali. *Human Ecology*, *25*(1), 121–143.

Berkes, F. (2007). Community-based conservation in a globalized world. *Proceedings of the National Academy of Sciences*, *104*(39), 15188–15193.

Beyene, T., Lettenmaier, D. P., & Kabat, P. (2010). Hydrologic impacts of climate change on the Nile River Basin: implications of the 2007 IPCC scenarios. *Climatic Change*, *100*(3-4), 433–461.

BGS (2002). Grounwater Quality: Mali. Tech. rep., British Geological Survey (National Environment Research Council).

Biggs, S. (1989). Resource-Poor Farmer Participation Research: A Synthesis of Experiences from Nine National Agricultural Research Systems. Tech. Rep. OFCOR Comparative Study Paper No.3, International Service for National Agricultural Research.

Bloom, D. E. (2006). Education in a Globalized World. *World Economics*, *7*(4), 87–109.

Bloom, D. E., Sachs, J. D., Collier, P., & Udry, C. (1998). Geography, demography,

and economic growth in africa. *Brookings Papers on Economic Activity*, *1998*(2), 207–295.

Blumenthal, D., & Jannink, J.-L. (2000). A classification of collaborative management methods. *Conservation Ecology*, *4*(2), 13.

Boko, M., Niang, I., Nyong, A., Vogel, C., Githeko, A., Medany, M., Osman-Elasha, B., Tabo, R., & Yanda, P. (2007). *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, chap. Africa, (pp. 433–467). Cambridge, UK: Cambridge University Press.

Bontkes, T. S., & Keulen, H. v. (2003). Modelling the dynamics of agricultural development at farm and regional level. *Agricultural Systems*, *76*(1), 379–396.

Boone, C., Glick, P., & Sahn, D. E. (2010). Household Water Supply Choice and Time Allocated to Water Collection: Evidence from Madagascar. Tech. rep. Working paper 238 (Cornell Food and Nutrition Policy Program).

Boserup, E. (2007). *Woman's Role in Economic Development*. London, UK: Earthscan Publications, Ltd., 1st edition ed.

Bourdieu, P., & Wacquant, L. (1992). *An Invitation to Reflexive Sociology*. Chicago: University of Chicago Press.

Buenavista, G., & Flora, C. B. (1994). *Tools for the Field*, chap. Participatory Methodologies for Analyzing Household Activities, Resources, and Benefits, (pp. 36–44). West Hartford: Kumarian Press.

Buijsrogge, P. (1989). *Initiatives paysannes en Afrique de l'Ouest*. Paris: L'Harmattan.

Castle, S. E. (1993). Intra-household differentials in women's status: household function and focus as determinants of children's illness management and care in rural Mali. *Health Transition Review*, *3*(2), 137–156.

Cavin, M. (2007). *Global issues in language, education and development: perspectives from postcolonial countries*, chap. Global issues in language, education and development, (pp. 157–186). Clevedon, UK: Multilingual Matters Ltd.

Charles, N. (2006). *Sociology: The key concepts*, chap. Gender, (pp. 72–75). New York: Routledge.

Chase, L., Schusler, T., & Decker, D. (2000). Innovations in stakeholder involvement: What's the next step? *Wildlife Society Bulletin*, *28*(1), 208–217.

Cleaver, F. (1998). Incentives and informal institutions: Gender and the management of water. *Agriculture and Human Values*, *15*, 347–360.

Cockburn, J., & Dostie, B. (2007). Child Work and Schooling: The Role of Household Asset Profiles and Poverty in Rural Ethiopia. *Journal of African Economies*, *16*(4), 519–563.

Cohen, J. M., & Uphoff, N. T. (1977). *Rural development participation: concepts and measures for project design, implementation and evaluation*. No. 2 in Rural Development Monograph. Ithaca, NY: Rural Development Committee, Center for International Studies, Cornell University.

Cohen, J. M., & Uphoff, N. T. (1980). Participation's place in rural development: Seeking clarity through specificity. *World Development*, *8*, 213–235.

Coleman, J. (1988). Social Capital in the Creation of Human Capital. *American Journal of Sociology*, *94*, S95–S120.

Coleman, J. (1994). *Foundations of Social Theory*. Cambridge, MA: Belknap Press.

Collier, P. (2007). *The Bottom Billion: Why the poorest countries are failing and what can be done about it*. New York: Oxford University Press.

Collier, P., Conway, G., & Venables, T. (2008). Climate change and Africa. *Oxford Review of Economic Policy*, *24*(2), 337–353.

Collier, P., & Dollar, D. (2004). Development Effectiveness: What Have We Learnt? *The Economic Journal*, *114*, F244–F271.

Collins, R. O., & Burns, J. M. (2007). *A History of Sub-Saharan Africa*, chap. European colonial rule in Africa, (pp. 296–308). Cambridge, UK: Cambridge University Press.

Condé, M. (1987). *Segu*. New York: Penguin Books.

Cooke, B., & Kothari, U. (2001). *Participation: The New Tyranny?*. New York: Zed Books.

Cooper, F. (1997). *International Development and the Social Sciences: Essays on the History and Politics of Knowledge*, chap. Modernizing Bureaucrats, Backward Africans, and the Development Concept, (pp. 64–92). University of California Press.

Cooperrider, D., & Whitney, D. (1999). *A Positive Revolution in Change: Appreciative Inquiry*, chap. A Positive Revolution in Change: Appreciative Inquiry, (pp. 242–265). San Francisco: Barrett-Koehler Publishers.

Cornwall, A. (2003). Whose Voices? Whose Choices? Reflections on Gender and Participatory Development. *World Development*, *31*(8), 1325–1342.

Cornwall, A. (Ed.) (2005). *Readings in Gender in Africa*. Bloomington: Indiana University Press.

Cotula, L. (2008). Law and Power in Decentralised Natural Resource Management: A Case Study from the Inner Niger Delta, Mali. *Afriche e Orienti, Special Issue II: Decentralising Power and Resource Control in Sub-Saharan Africa: Responses and Perspectives*.

Cotula, L., & Vermeulen, S. (2009). Deal or no deal: the outlook for agricultural land investment in Africa. *International Affairs*, *85*(6), 1233–1247.

Cotula, L., Vermeulen, S., Leonard, R., & Keeley, J. (2009). Land grab or development opportunity? Agricultural investment and international land deals in Africa. Tech. rep., IIED/FAO/IFAD, London/Rome.

Coulibaly, O. N. (1995). *Devaluation, new technologies, and agricultural policies in the Sudanian and Sudano-Guinean zones of Mali*. Ph.D. thesis, Purdue University.

Coulibaly, Y. M., & Belieres, J.-F. (2006). Contrainte fonciere et strategie d'appropriation par les exploitations agricoles du grand perimetre irrigue de l'Office du Niger au Mali. In J. J. T. R. A. Richard, P. Caron (Ed.) *Coordination Hydraulique et Justices Sociales*, Actes du Seminaire, (p. 13). Montpellier: Cirad.

Critchley, W., & Siegert, K. (1991). Water Harvesting. Tech. Rep. (AGL/MISC/17/91), Food and Agriculture Organization of the United Nations (FAO), Rome.

CRLP (1999). Women of the World: Laws and Policies Affecting their Reproductive Lives (Francophone Africa). Tech. rep., Center for Reproductive Law and Policy, New York.

Cunningham, J. J. (2009). Pots and political economy: enamel-wealth, gender, and patriarchy in Mali. *The Journal of the Royal Anthropological Institute*, *15*(2), 276–294.

Davis, M. (2002). The Origins of the Third World: Markets, States and Climate. Briefing 27, The Corner House, London.

Day, S. J. (2009). Community-based water resources management. *Waterlines*, *28*(1), 47–62.

de Wit, M., & Stankiewicz, J. (2006). Changes in Surface Water Supply Across Africa with Predicted Climate Change. *Science*, *311*, 1917–1921.

Dembélé, N. N., & Staatz, J. M. (2000). *Democracy and Development in Mali*, chap. The Response of Cereals Traders to Agricultural Market Reform in Mali, (pp. 145–165). Michigan State University Press.

DeStefano, J. (2006). Meeting EFA: Mali Community Schools. Tech. rep., USAID Educational Quality Improvement Program.

Devasia, L. (1998). Safe Drinking Water and its Acquisition: Rural Women's Participation in Water Management in Maharashtra, India. *Water Resources Development*, *14*(4), 537–546.

Diamond, J. (1999). *Guns, Germs, and Steel: The Fate of Human Societies*. New York: W.W. Norton & Company, Inc.

Dickerson-Putman, J., & Brown, J. K. (Eds.) (1998). *Women Among Women: Anthropological Perspectives on Female Age Hierarchies*. Champaign: University of Illinois Press.

DNCT/CCN (2003). La Planifacation du Développement Local au Mali. 2ème atelier national d'échanges inter CCC/CCN.

Dube, D., & Swatuk, L. (2002). Stakeholder participation in the new water management approach: a case study of the Save catchment, Zimbabwe. *Physics and Chemistry of the Earth*, *27*(11-22), 867–874.

Earthtrends (2003). Water Resources and Freshwater Ecosystems (Country Profiles: USA, UK, Mali, Ghana, Niger, Bangladesh). Tech. rep., Earthtrends Institute.

Easterly, W. (2001). The Effect of IMF and World Bank Programmes on Poverty. Tech. Rep. Discussion Paper No. 2001/102, World Institute for Development Economics Research.

Elson, D. (1991). *Male Bias in the Development Process*, chap. Male Bias in the Development Process: An Overview, (pp. 1–15). Manchester: Manchester University Press.

Escobar, A. (1997). *The Post-Development Reader*, chap. The Making and Unmaking of the Third World Through Development, (pp. 84–93). London: Zed Books.

Esteva, G. (1991). *The Development Dictionary: A guide to knowledge as power*, chap. Development, (pp. 7–25). London: Zed Books.

Falkenmark, M., & Widstrand, C. (1992). Population and Water Resources: A Delicate Balance. Prb population bulletin, Population Reference Bureau, Washington, DC.

Feldstein, H. S., & Poats, S. (1994). *Tools for the Field*, chap. A Gender-disaggregated Activity Calendar, (pp. 103–105). West Hartford: Kumarian Press.

Field, J. (2003). *Social Capital*. London: Routledge.

Filipovich, J. (2001). Destined to Fail: Forced Settlement at the Office du Niger, 1926-45. *The Journal of African History*, *42*(2), 239–260.

Fisher, W., Meierotto, L., & Russell, R. (2001). The Talo Dam Project (Projet de Mise en Valeur des Plaines du Moyen Bani). Tech. rep., Clark University.

Fraser, N. (1997). *Justice Interrupts: Critical Reflections on the "Postsocialist" Condition*. New York.

Gleitsmann, B. (2005). *The Importance of Community Involvement in the Planning and Design Phases of Rural Water Supply Development Projects in the Koro Region of Mali, West Africa*. Master's thesis, Cornell University, Ithaca, NY.

Goetz, A. M. (2002). *The Earthscan Reader on NGO Management*, chap. Getting Institutions Right for Women in Development, (pp. 389–405). London: Earthscan Publications, Ltd.

Grandin, B. (1994). *Tools for the Field*, chap. Wealth Ranking, (pp. 21–35). West Hartford: Kumarian Press.

Gray, L., & Kevane, M. (1999). Diminished Access, Diverted Exclusion: Women and Land Tenure in Sub-Saharan Africa. *African Studies Review*, *42*(2), 15–39.

Grigsby, W. (1996). Women, Descent, and Tenure Succession among the Bambara of West Africa: A Changing Landscape. *Human Organization*, *55*(1), 93–98.

Grosz-Ngaté, M. (1989). Hidden Meanings: Explorations into a Bamanan Construction of Gender. *Ethnology*, *28*(2), 167–183.

Gugerty, M. K. (2008). The effectiveness of NGO self-regulation: Theory and evidence from Africa. *Public Administration and Development*, *28*, 105–118.

Hammersley, M. (2000). *Taking Sides in Social Research: Essays on Partisanship and Bias*. London: Routledge.

Hardin, G. (1968). The Tragedy of the Commons. *Science*, *162*, 1243–1248.

Harris, C. (2006). Doing Development with Men: Some Reflections on a Case Study from Mali. *IDS Bulletin*, *37*(6), 47–56.

Harvey, P., & Reed, R. (2003). Sustainable rural water supply in africa: Rhetoric and reality. 29th wedc international conference, Abuja, Nigeria.

Hellevik, S. B. (2004). *Has decentralization contributed to democratization at the local level in Mali? A comparative study of three local governments: Kontela, Mopti and Tambaga*. Master's thesis, University of Oslo, Oslo, Norway.

Hicks, C. (2008). Misery in Mali's cotton-picking fields. BBC News.

Hilhorst, T., & Coulibaly, A. (1999). *Towards Negotiated Co-Management of Natural Resources in Africa*, chap. Creating Opportunities for Village-level Management of Woodlands in Southern Mali, (pp. 255–273). Muenster, Germany: Lit Verlag.

Holland, J., & Campbell, J. (2005). *Methods in Development Research*, chap. Introduction: Bridges and Fences for Combined Methods, (pp. 21–26). Warwickshire, UK: ITDG Publishing.

INSTAT (2009). Resultats Provisoires RGPH 2009 (Région de Ségou). Tech. rep., Institut National de la Statistique: République du Mali.

IPCC (2007). Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. (p. 104). Geneva.

IRIN (2009). Mali: Land grab fears linger.

Isham, J., & Kahkonen, S. (2002). Institutional Determinants of the Impact of Community-Based Water Services: Evidence from Sri Lanka and India. *Economic Development and Cultural Change*, *50*(3), 667–692.

Jackson, S. K., & Apambire, W. B. (2008). West Africa Water Initiative Phase II Water, Sanitation, and Hygiene for West Africa Water Initiative Phase II Water, Sanitation, and Hygiene for Human Development. Proposal, World Vision International.

James, A. J., Verhagen, J., van Wijk, C., Nanavaty, R., Parikh, M., & Bhatt, M. (2002). Transforming time into money using water: A participatory study of economics and gender in rural India. Tech. Rep. 3.

Johnson, B., & Turner, L. (2003). *Handbook of Mixed Methods in Social and Behavioral Research*, chap. Data Collection Strategies in Mixed Methods Research, (pp. 297–319). Thousand Oaks, CA: Sage Publications.

Joireman, S. F. (2008). The Mystery of Capital Formation in Sub-Saharan Africa: Women, Property Rights and Customary Law. *World Development*, *36*(7), 1233–1246.

Jonckers, D. (1994). *Les associations paysannes en Afrique*, chap. Le mythe d'une

tradition communautaire villageoise dans la région Mali-Sud, (pp. 121–34). Paris: Karthala/APAD/IUED.

Jones, W. (1976). *Planning and economic policy in socialist Mali and her neighbors*. Washington, DC: Three Continents Press.

Kamuanga, M. J., Somda, J., Sanon, Y., & Kagoné, H. (2008). Livestock and regional market in the Sahel and West Africa: Potentials and challenges. Tech. rep., SWAC-OECD/ECOWAS, Paris.

Kassa, H., Gibbon, D., & Singh, B. P. (2002). Livestock Improve Household Food Security and Sustainability of Ethiopian Small Farms. *Journal of Sustainable Agriculture*, *21*(2), 73–93.

Kemper, E. A., Stringfield, S., & Teddlie, C. (2003). *Handbook of Mixed Methods in Social and Behavioral Research*, chap. Mixed Methods Sampling Strategies in Social Science Research, (pp. 273–296). Thousand Oaks, CA: Sage Publications.

Kibaroglu, A. (2002). *Building a regime for the waters of the Euphrates-Tigris River Basin*. International and National Water Law and Policy Series. The Netherlands: Kluwer Law International.

Klaartje, V., Keita, A. C., Coulibaly, Y., Raes, D., & Jamin, J.-Y. (2007). Formal and informal decision-making on water management at the village level: A case study from the Office du Niger irrigation scheme (Mali). *Water Resources Research*, *43*, 1–10.

Klaartje, V., Keita, A. C., Kaloga, K., Coulibaly, Y., Raes, D., & Jamin, J.-Y. (2006). Sustainability of farmers' organization of water management in the Office du Niger irrigation scheme in Mali. *Irrigation and Drainage*, *55*(1), 51–60.

Kleemeier, E. (2000). The Impact of Participation on Sustainability: An Analysis of the Malawi Rural Piped Scheme Program. *World Development*, *28*(5), 929–944.

Koenig, D., & Diarra, T. (1998). The Environmental Effects of Policy Change in the West African Savanna: Resettlement, Structural Adjustment and Conservation in Western Mali. *Journal of Political Ecology*, *5*, 23–52.

Kolff, H., & Wilson, R. (1985). Livestock Production in Central Mali: The 'Mouton de Case' System of Smallholder Sheep Fattening. *Agricultural Systems*, *16*, 217–230.

Kotzé, D. A. (2003). Role of women in the household economy, food production and food security: Policy guidelines. *Outlook on Agriculture*, *32*(2), 111–121.

Laugharn, P. (2007). Negotiating 'Education for Many': Enrolment, Dropout and Persistence in the Community Schools of Kolondièba, Mali. Tech. Rep. Research Monograph No. 14, Consortium for Research on Educational Access, Transitions and Equity.

Leeuwis, C., & Pyburn, R. (2002). *Wheel-barrows Full of Frogs: Social Learning in Rural Resource Management*, chap. Social learning for rural resource management, (pp. 11–24). The Netherlands: Koninklijke Van Gorcum.

Lewis, J., & Ritchie, J. (2003). *Qualitative Research Practice: A Guide for Social Science Students and Researchers*, chap. Generalising from Qualitative Research, (pp. 263–286). Thousand Oaks, CA: Sage Publications.

Lewis, M. P. (2010). Ethnologue: Languages of the World, Sixteenth edition.

Lightfoot, C., Feldman, S., & Abedin, M. Z. (1994). *Tools for the Field*, chap. Incorporating Gender in Conceptual Diagrams of Households and Agroecosystems, (pp. 66–70). West Hartford: Kumarian Press.

Lindenberg, M. (2002). Measuring Household Livelihood Security at the Family and Community Level in the Developing World. *World Development*, *30*(2), 301–318.

Lockridge, S. (2006). *Conceptions of power and empowerment: A case study of women's associations in Segou, Mali*. Ph.D. thesis, American University, Washington, DC.

Ludi, E. (2009). Climate change, water and food security. Background note, Overseas Development Institute, London, UK.

Lutz, A., Thomas, J. M., Pohll, G., Keita, M., & McKay, W. A. (2009). Sustainability of groundwater in Mali, West Africa. *Environmental Geology*, *58*(7), 1441–1450.

Macro (2010). Measure DHS STATcompiler. www.measuredhs.com.

Mali (2000). Strategie Nationale de Developpement de l'Alimentation en Eau Potable et de l'Assainissement en Milieu Rural et Semi-Urbain. Tech. rep., République du Mali (Ministère des Mines, de l'Énergie, et de l'Eau).

Mali (2006). Cadre de Depanses a Moyen Terme du Secteur de l'Education 2006-08. Tech. rep., Ministère de l'Education Nationale (République du Mali), Bamako.

Marglin, S. A. (1990). *Dominating Knowledge: Development, Culture, and Resistance*, chap. Towards the Decolonization of the Mind, (pp. 1–28). New York: Oxford University Press.

MATCL (2005). Plan de dévelopement économique, social et culturel: Cercle de San 2006-2010. Tech. rep., Ministère de l'Administration Territoriale et des Collectivités Locales, San, Mali.

Mayoux, L., & Hartl, M. (2009). Gender and rural microfinance: Reaching and empowering women. Tech. rep., International Fund for Agricultural Development (IFAD), Rome, Italy.

Mays, N., & Pope, C. (1995). Qualitative Research: Rigour and qualitative research. *BMJ*, *311*, 109–112.

Meinzen-Dick, R., & Zwarteveen, M. (2003). *Household decisions, gender, and development: A synthesis of recent research*, chap. Gendered participation in water management: Issues from water users' associations in South Asia, (pp. 153–158). Washington, D.C.: International Food Policy Research Institute (IFPRI).

Michael, B. (1998). The Role of Women in Water Resources Management: The Tanzania Case. *Water Resources Development*, *14*(4), 499–504.

Moritz, M., Kyle, B. R., Nolan, K. C., Patrick, S., Shaffer, M. F., & Thampy, G. (2009). Too Many People and Too Few Livestock in West Africa? An Evaluation of Sandford's Thesis. *Journal of Development Studies*, *45*(7), 1113–1133.

Narayan, D., & Pritchett, L. (1999). Cents and Sociability: Household Income and Social Capital in Rural Tanzania. *Economic Development and Cultural Change*, *47*(4), 871–897.

N'Djim, H., & Bakary, D. (1996). Water and population dynamics: case studies and policy implications, American Association for the Advancement of Science. chap. Case study: Mali population and water issues.

Nelson, F., & Agrawal, A. (2008). Patronage or Participation? Community-based Natural Resource Management Reform in Sub-Saharan Africa. *Development and Change*, *39*(4), 557–585.

Niasso (2006). Plan de dévelopement économique, social et culturel: Periode 2006-2010. Tech. rep., Cercle de San [Région de Ségou], Commune rurale de Niasso, Cercle de San, Région de Ségou.

Norman, W. R. (1997). Indigenous community-managed irrigation in Sahelian West africa. *Agriculture, Ecosystems and Environment*, *61*(2-3), 83–95.

Omer, A. (2003). Water resources and supply policy in developing countries with special reference to Sudan. *Journal of Water Supply: Research and Technology*, *52*(3), 217–223.

Onibon, A., Dabire, B., & Ferroukhl, L. (1999). Local practices and the decentralization and devolution of natural resource management in French-speaking West Africa. *Unasylva*, *50*(4), 23–27.

Opare, S. (2005). Engaging women in community decision-making processes in rural ghana: problems and prospects. *Development in Practice*, *15*(1), 90–99.

Ostrom, E. (1990). *Governing the Commons: The evolution of institutions for collective action*. Cambridge: Cambridge University Press.

PACT (2007). Guide juridique: La ressource naturelle [Eau]. Tech. rep., Programme d'Appui aux Collectivités Territoriales, Bamako.

Patton, M. Q. (1990). *Qualitative evaluation and research methods, 2nd edition*. Newbury Park, CA: Sage Publications.

Paturel, J.-E., Ouedraogo, M., Servat, E., Mahe, G., Dezetter, A., & Boyer, J.-F. (2003). The concept of rainfall and streamflow normals in west and central africa in a context of climatic variability. *Hydrological Sciences*, *48*(1), 125–137.

Pimbert, M. (2009). Towards Food Sovereignty: Reclaiming autonomous food systems. Tech. rep., International Institute for Environment and Development (IIED), London, UK.

Poff, N. L., Allen, J. D., Bain, M. B., Karr, J. R., Prestegaard, K. L., Richter, B. D., Sparks, R. E., & Stromberg, J. C. (1997). The natural flow regime. *Bioscience*, *47*(11), 769–784.

Pretty, J., & Ward, H. (2001). Social Capital and the Environment. *World Development*, *29*(2), 209–227.

Prokopy, L. S. (2009). Determinants and benefits of household level participation in rural drinking water projects in india. *Journal of Development Studies*, *45*(4), 471–495.

Putnam, R. D. (2000). *Bowling Alone: The Collapse and Revival of American Community*. New York: Simon and Schuster.

Rahnema, M. (1991). *The Development Dictionary: A guide to knowledge as power*, chap. Participation, (pp. 116–131). London: Zed Books.

Rahnema, M. (1997). *The Post-Development Reader*, chap. Towards Post-Development: Searching for Signposts, a New Language and New Paradigms, (pp. 377–404). London: Zed Books.

Ramisch, J. J. (1998). *Cattle, cotton, and carts: Livestock and agricultural intensification in southern Mali*. Ph.D. thesis, University of East Anglia, Norwich (United Kingdom).

Rathgeber, E. (1996). *Water management in Africa and the Middle East: Challenges and Opportunities*, chap. Women, Men, and Water-Resource Management in Africa, (pp. 49–69). Ottawa: International Development Research Centre (IDRC).

Rathgeber, E. (2003). Dry Taps ... Gender and Poverty in Water Resource Management. Tech. rep., Food and Agriculture Organization of the United Nations (FAO).

Rawson, D. (2000). *Democracy and Development in Mali*, chap. Dimensions of Decentralization in Mali, (pp. 265–288). East Lansing: Michigan State University Press.

Regmi, S., & Fawcett, B. (1999). Integrating gender needs into drinking-water projects in Nepal. *Gender and Development*, *7*(3), 62–72.

Ribot, J. (1996). Participation without representation: Chiefs, Councils and Forestry Law in the West African Sahel. *Cultural Survival Quarterly*, *20*(3), 40–44.

Riddell, J. B. (1992). Things Fall Apart Again: Structural Adjustment Programmes in Sub-Saharan Africa. *The Journal of Modern African Studies*, *30*(1), 53–68.

Ruel, M. T., Minot, N., & Smith, L. (2004). Patterns and determinants of fruit and vegetable consumption in sub-saharan africa: a multicountry comparison. Background paper for the joint fao/who workshop on fruit and vegetables for health, 1-3 spetember 2004, kobe, japan, World Health Organization (WHO), Washington, D.C.

Schneiderman, J., & Reddock, R. (2004). Water, women and community in Trinidad, West Indies. *Natural Resources Forum*, *28*(3), 179–188.

Schreiner, B., Mohapi, N., & van Koppen, B. (2004). Washing away poverty: Water, democracy and gendered poverty eradication in South Africa. *Natural Resources Forum*, *28*(3), 171–178.

Scoones, I. (2005). Sustainable Rural Livelihoods: A framework for analysis. Tech. Rep. IDS Working Paper 72, Institute of Development Studies, Sussex.

Scott, J. W. (1986). Gender: A Useful Category of Historical Analysis. *The American Historical Review*, *91*(5), 1053–1075.

Sen, A. (2001). *Frontiers of Development Economics*, chap. What is Development About?, (pp. 506–513). New York: Oxford University Press.

Serrat, O. (2008). The Sustainable Livelihoods Approach. Tech. Rep. Knowledge Solutions No. 15, Asian Development Bank.

Shah, M. M., Fischer, G., & van Velthuizen, H. (2008). Food Security and Sustainable Agriculture the Challenges of Climate Change in Sub-Saharan Africa.

Singh, N., Jacks, G., & Bhattacharya, P. (2005). Women and community water supply programmes: An analysis from a socio-cultural perspective. *Natural Resources Forum*, *29*(3), 213–223.

Singh, S. (2007). Deconstructing 'gender and development' for 'identities of women'. *International Journal of Social Welfare*, *16*, 100–109.

Sissoko, B. M. (2010). Farmers 'jury' voices agricultural research concerns. www.scidev.net.

Smith, L. C., Ramakrishnan, U., Ndiaye, A., Haddad, L., & Martorell, R. (2003). The Importance of Women's Status for Child Nutrition in Developing Countries. Research Report 3, International Food Policy Research Institute, Washington, D.C.

Spivak, G. C. (1988). *Marxism and the Interpretation of Culture*, chap. Can the Subaltern Speak?, (pp. 271–313). Urbana, IL: University of Illinois Press.

Summers, L. (1993). The most influential investment. *People and the Planet*, *2*(1), 10.

Sutcliffe, B. (1995). *From Modernization to Globalization*, chap. Development after Ecology, (pp. 328–339). Oxford: Blackwell Publishers.

Sylvester, C. (2006). Bare life as a development/postcolonial problematic. *The Geographical Journal*, *172*(1), 66–77.

Tapela, B. (2002). The challenge of integration in the implementation of Zimbabwe's new water policy: case study of the catchment level institutions surrounding the Pungwe-Mutare water supply project. *Physics and Chemistry of the Earth*, *27*(11), 993–1004.

Teddlie, C., & Tashakkori, A. (2003). *Handbook of Mixed Methods in Social and Behavioral Research*, chap. Major Issues and Controversies in the Use of Mixed Methods in the Social and Behavioral Sciences, (pp. 3–50). Thousand Oaks, CA: Sage Publications.

Tounkara, B. (2001). Le Rôle des ONG dans l'Éducation de Base au Mali. Tech. rep., Recherche sur Education en Afrique de l'Ouest et Centres (ROCARE's), Bamako.

Trudell, B. (2007). Local community perspectives and language of education in Sub-Saharan African communities. *International Journal of Educational Development*, *27*(5), 552–563.

UN (2010). The Millennium Development Goals Report 2010. Tech. rep., United Nations, New York.

UNDESA, & GWTF (2005). A Gender Perspective on Water Resources and Sanitation: Background Paper submitted to the Commission on Sustainable Development. Tech. Rep. CSD-12 Background Paper, United Nations, New York.

UNDP (2007/2008). Human Development Report. Tech. rep., United Nations Development Programme.

UNDP (2010). Human Development Report 2010 (the Real Wealth of Nations: Pathways to Human Development. Tech. rep., United Nations Development Programme, New York.

UNEP (2010). *Africa Water Atlas*, chap. Transboundary Water Resources: Niger River Basin, (p. 326). Nairobi, Kenya: United Nations Environment Programme (UNEP).

UNESCO (2009). The 3rd United Nations World Water Development Report: Water in a Changing World. Tech. rep., United Nations.

UNHRC (2003). International Covenant on Civil and Political Rights: Consideration of Mali by the Human Rights Committee under the procedure for countries that have not submitted periodic reports, 77th Session. Tech. rep., United Nations Human Rights Commission.

Uphoff, N., & Esman, M. (1974). *Local organizations for rural development: Analysis of Asian experience*. Ithaca, NY: Center for International Studies, Cornell University.

Uphoff, N., & Wijayaratna, C. (2000). Demonstrated Benefits from Social Capital: The Productivity of Farmer Organizations in Gal Oya, Sri Lanka. *World Development*, *28*(11), 1875–1890.

Urama, K. C., & Ozor, N. (2010). Impacts of Climate Change on Water Resources in Africa: the Role of Adaptation. Tech. rep., African Technology Policy Studies Network (ATPS).

USAID (2007). Mali Food Security Update. Tech. rep., Famine Early Warning Systems Network.

USDS (2010). Background note: Mali. Tech. rep., United States Department of State.

Valdivia, C., & Gilles, J. (2001). Gender and resource management: Households and groups, strategies and transitions. *Agriculture and Human Values*, *18*, 5–9.

van Rouveroy van Nieuwaal, E. A. B., & van Nieuwaal, M. R. (2003). J'y crois: la route de la décentralisation au Mali. DVD video.

Van Wijk-Sijbesma, C. (1998). Gender in Water Resources Management, Water Supply and Sanitation: Roles and Realities Revisited. Tech. rep., International Research Centre for Water and Sanitation, Delft, the Netherlands.

Washbrook, D. (1997). From Comparative Sociology to Global History: Britain and India in the Pre-History of Modernity. *Journal of the Economic and Social History of the Orient*, *40*(4), 410–443.

WB (2003). Water Resources Sector Strategy: Strategic Directions for World Bank Engagement. Tech. Rep. 28114, International Bank for Reconstruction and Development/The World Bank, Washington, DC.

Wegner, D. L. (2010). New Ideas for Old Dams: Developing Solutions for a Shrinking Colorado River. *Golden Gate University Environmental Law Journal*, *2*(1), 69–95.

Welsh, P. (2010). Community development: a gendered activism? The masculinities question. *Community Development Journal*, *45*(3), 297–306.

Wilmsen, C. (2006). Participation, Reciprocity, and Empowerment in the Practice of Participatory Research. Tech. rep., University of California, Berkeley (College of Natural Resources).

Woodhouse, P., & Chimhowu, A. (2005). *A Radical History of Development Studies: Individuals, Institutions, and Ideologies*, chap. Development studies, nature and natural resources: changing narratives and discursive practices, (pp. 180–199). London: Zed Books.

WV (2000). The WATSAN Training Manual. Tech. Rep. Training Manual 6, World Vision Ghana Rural Water Project, Kumasi, Ghana.

WV (2005). Diéli ADP TDI Report. Tech. rep., World Vision Mali, San, Mali.

WV (2006a). Rapport de Diagnostic Koodugu ADP. Tech. rep., World Vision Mali, San, Mali.

WV (2006b). Sanké ADP Redesign Document. Tech. rep., World Vision Mali, San, Mali.

WV (2007a). Diéli ADP Design Document. Tech. rep., World Vision Mali, San, Mali.

WV (2007b). Diéli ADP FY08 Operational Plan. Tech. rep., World Vision Mali, San, Mali.

WV (2007c). Koodugu ADP Previsional Design Document. Tech. rep., World Vision Mali, San, Mali.

WV (2008a). Diéli ADP Profile. Tech. rep., World Vision Mali, San, Mali.

WV (2008b). Koodugu ADP FY08 Operational Plan. Tech. rep., World Vision Mali, San, Mali.

WV (2008c). Sanké ADP Profile. Tech. rep., World Vision Mali, San, Mali.

Zoomers, A. (2010). Globalisation and the foreignisation of space: seven processes driving the current global land grab. *Journal of Peasant Studies*, *37*(2), 429–447.